OTTAWA NATIONAL WILDLIFE REFUGE COMPLEX

ANNUAL WATER MANAGEMENT PROGRAM

REVIEW AND APPROVAL

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Prepared by

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DATE

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DATE

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WATER MANAGEMENT PLAN - 1987

This annual water management plan for the Ottawa NWR Complex provides guidelines for water levels during a record high lake level year and in a year when funding for pumping has been cut 50% over 1986.

All time high records were recorded for every month but April in 1986. The outlook for Lake Erie according to the Corps of Engineers is for the lake to remain near or above record levels at least through July 1987. These high levels are adversely impacting on wetland habitat in several ways.

Most refuge facilities were built during normal or low water years (with the exception of the 1972-73 period) and getting enough water to raise water levels in wetlands was a problem. Northeast storms have always been a problem but overall water levels have been near normal the last 25 years. In the mid to late 1970's energy conservation was a factor in the design of water control structures. Dual flap gates on screw gates that faced in opposite directions were installed. Gravity was all the energy that was needed and the system worked well during those years. The key was to have a water source that periodically fluctuated and wind tides on Lake Erie cooperated with each blow from the southwest and northeast.

With record high water levels several adverse impacts are occurring. Gravity control structures are not working, severe erosion is taking place on all unprotected dikes, and any defects in dikes and control structures are showing up. Muskrat and groundhog damage to dikes becomes more apparent as the dikes narrow from erosion and water pressure finds many of the burrows. Defects in pipes or gates become more serious as the pressure from the high water tests their utility. Carp find those dike leaks and can wallow out several feet of dike in short order.

Due to the inability to gravity drain, hundreds of acres of emergent vegetation has drowned. At Darby and Cedar Point NWR the high water level damage is most apparent. High water levels in 1985 eliminated and stressed hundreds of acres in both units. Continued high water in 1986 drowned most of what survived 1985

In some areas ever increasing water levels are creating excellent emergent wetlands that a few years ago were grow back fields and goose shooting fields.

Aerial infrared photos were taken 8/15/86 to document wetland conditions. Maps were not developed from the 1986 photos as they were in 1985. Prints were made from transparencies on a select few areas due to cost.

Most of the prints developed are included in the appendix of this report.

Water levels described in this plan in many cases are planned to prevent erosion and reduce pumping costs. Several units were not filled in the fall of 1986 because of reduced funding for pumping. Waterfowl use was well below what was possible. Water levels in several units will now be managed not for waterfowl but to protect Service facilities. Some units were kept dry in 1986 for dike repairs.

Total pumping costs for FY 86 were $11,796 and included $1,210 paid to ODNR for pumping Pool 1. Funds planned for pumping in FY 87 amount to $5,400.

The spread of purple loosestrife and control efforts are showing highly variable results. In several units high water is suppressing the pest plants and providing improved access for spraying. In those areas that were marginally wet a few years ago and are now emergent wetlands the loosestrife spread has stopped. First year plants are commonly found at waterline edges in shallow ditches, wet corners of fields, moist soil units, on sand bars/spits along the lakeshore and in almost every wet area one looks. Private wetlands and state park lands adjacent to the refuge are heavily infested and provide a constant source of re-infestation even when control actions are effective in removing adult plants. The only refuge unit that did not have any observed plants was Navarre. Overall the refuge is slowly losing the battle. Control expenditures at the level of the past few years is slowing the spread and stopping a rapid takeover.

normally you flood to
control woody vegetation
will you farm MU·3?

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Unit Objectives Summary for 1987

Ottawa NWR

Pool 1 - Gravity drainage if possible to stop dike erosion.

Pool 2A - Crisafulli drawdown to repair dike - no water added in fall.

Pool 2b - Precipitation in fall of 86 and spring of 87 will keep unit wet.

Pool 2c - Crisafulli drawdown to repair dike - no water in fall.

Pool 3 - Open to the lake - not covered.

Pool 4 - Open to the lake - not covered.

Pool 5 - Open to the lake - not covered.

Pool 6 - Hold water high to encourage muskrats to open dense cattails.

Pool 7 - Open to the lake - not covered.

Mini-Marsh - Hold water high to encourage muskrats to open dense Cattails.

Show Pool - Hold water high to kill cottonwoods/willows.

Headquarters Pool - Crisafulli drawdown to repair dikes, partially fill in fall.

MSU-3 - Drawdown with MS pump to control woody growth and make minor dike repairs, flood in fall.

MSU-4 - Farm to eliminate willows and reed-canary grass, partial flooding in fall.

MSU-5 - Farm to eliminate willows, partial flooding in fall.

MSU-6 - Open to the lake - not covered.

MSU-7A - Drawdown with farm pump for moist soil plants and access to borrow area for Stange Road bridge access project.

MSU-7B - Drawdown with farm pump for moist soil plants and access to borrow area for Stange Road bridge access project.

MSU-8A - Hold water high to kill cottonwood seedlings.

MSU-8B - Drawdown with farm pump for moist soil plants.

Navarre

Pool 1 - Partial drawdown by Toledo Edison pump for moist soil plants and to encourage emergents.

Navarre

Pool 2 - Partial drawdown by Toledo Edison pump for moist soil plants and to encourage emergents.

Darby

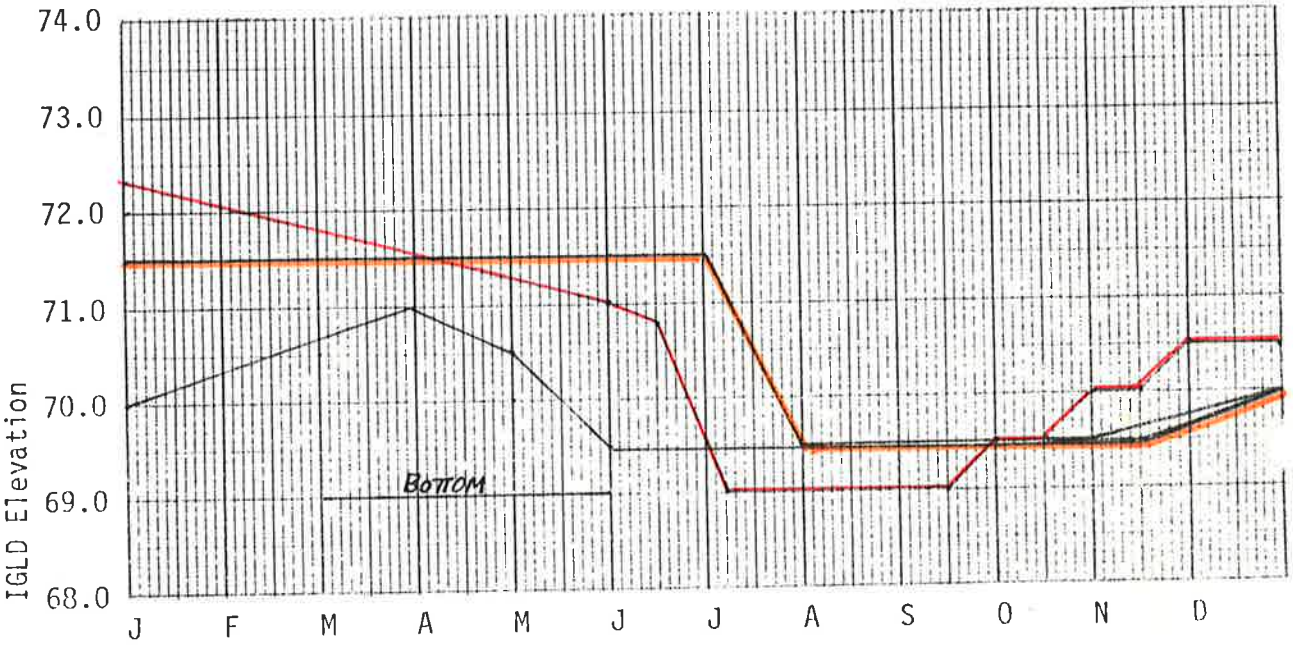
Pools 1,2,3 and 4 - Gravity drainage to maintain emergents and re-establish vegetation.

Cedar Point NWR

Pool - 1 and 2 - Gravity drainage to maintain and re-establish vegetation.

Pheasant Farm - Crisafulli drawdown to repair WCS, stop dike erosion and to re-vegetate.

1. Unit Pool 1
2. Acres 275
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 570.5
5. Elevation of general pool bottom 569
6. Water levels: 86 Planned ——; 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 5

Species	%1984	%1985	%1986
Open Water	65	75	65
Cattail	18	10	15
Aquatic Smartweed	11	10	10
Other	5	5	5
Smartweed			5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	4,200	4,200	30,000
Geese	2,200	2,200	4,000
GBH	1,000	1,000	2,000

9. Map: No map photo 8/15/86

10. Purple Loosestrife: Scattered plants throughout unit edges sprayed.

Pool 1

A.2 Effects of Past Year's Water Levels

Levels: High lake levels prevented any gravity drainage throughout the year. The high levels were drowning all emergent vegetation and severely eroding dike banks. A MOU was developed with ODNR to drawdown the unit with their pump. Adjacent ODNR units were drawndown first with the pool drawndown in July. The WCS was left high and dry before a complete drawdown could be achieved. The northern section of the pool became isolated from the southern portion after about 2 feet were removed.

Results: Even with the July drawdown cattail and nodding smartweed response was excellent on the higher elevations. Severe erosion was stopped and information gained on how to improve the effects of the next drawdown. The next drawdown will occur in May with a channel created from the WCS to the deepest portions of the south bay and connections made between the north and south bays.

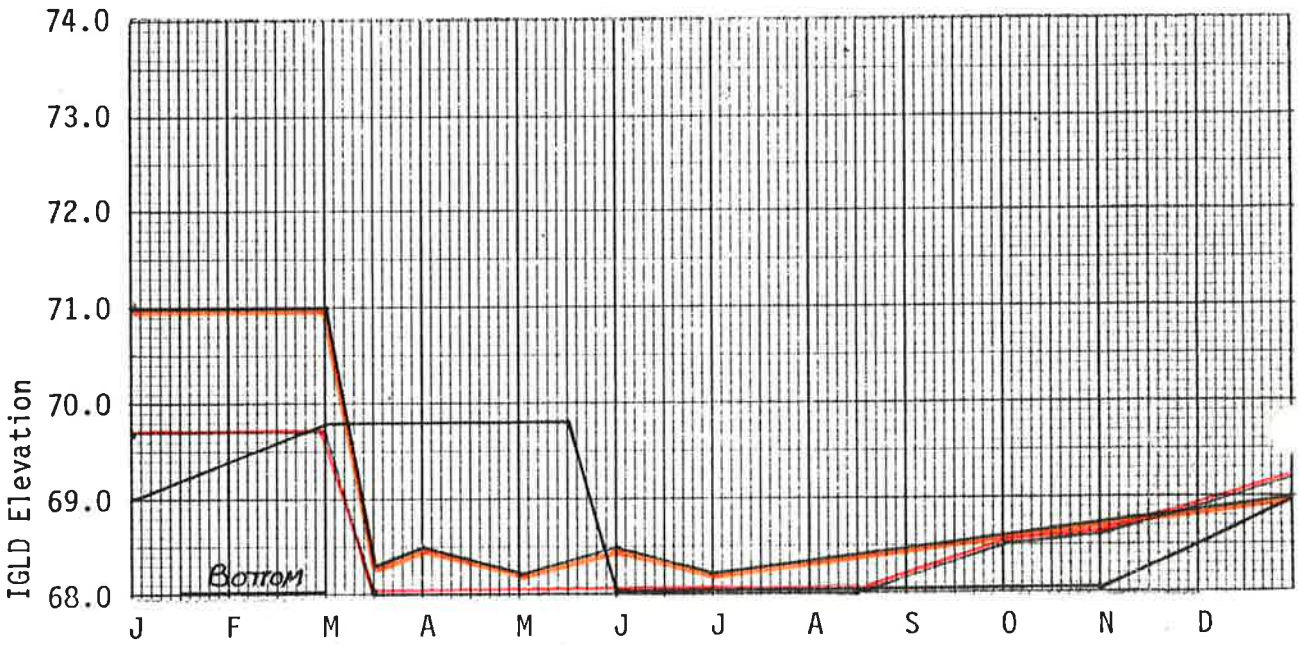
Facilities: The WCS in the SE corner is completely silted in and requires replacement. The NE and S dikes are 70% to 90% lost to erosion with the SW corner 50% lost.

Costs: All dikes were mowed twice. Electric pumping costs paid to ODNR totalled $1,300.

B.2 Objectives of the 1987 proposed Water Levels

Water levels will be lowered by gravity if possible throughout the year to maintain vegetation. Lower levels will reduce wave action and bank erosion.

1. Unit Pool 2a
2. Acres 70
3. Maximum elevation permissible 572
4. Flowline elevation of lowest structure 569
5. Elevation of general pool bottom 568
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Open Water	94	87	50
Wooded	5	5	5
Mixed Forbes/Other	0	2	25
Smartweed/Velvet Leaf	0	5	20
Aquatic Smartweed	1	1	0

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	1,500	1,500	25,000
Geese	3,000	3,000	15,000
GBH	200	300	1,000

9. Map: No map - photo 8/15/87

10. Purple Loosestrife: Moderate infestation noted around wooded island margin sprayed.

Pool 2a

A.2 Effects of Past Year's Water Levels

Levels: No water was added in the fall of 85 or spring of 86 but precipitation filled the pool and caused some erosion of the north and west dikes. The unit was pumped down dry as possible in May. Several old borrow areas and a low shallow area in the northern sections maintained water until August despite repeated attempts to pump them dry. Frequent rainfall equalled pumping.

Results: Vegetation response was moderate with smartweed stands excellent in some areas. Evaporation exposed mudflats of August developed little vegetation. Purple loosestrife is becoming a problem in the south-central area.

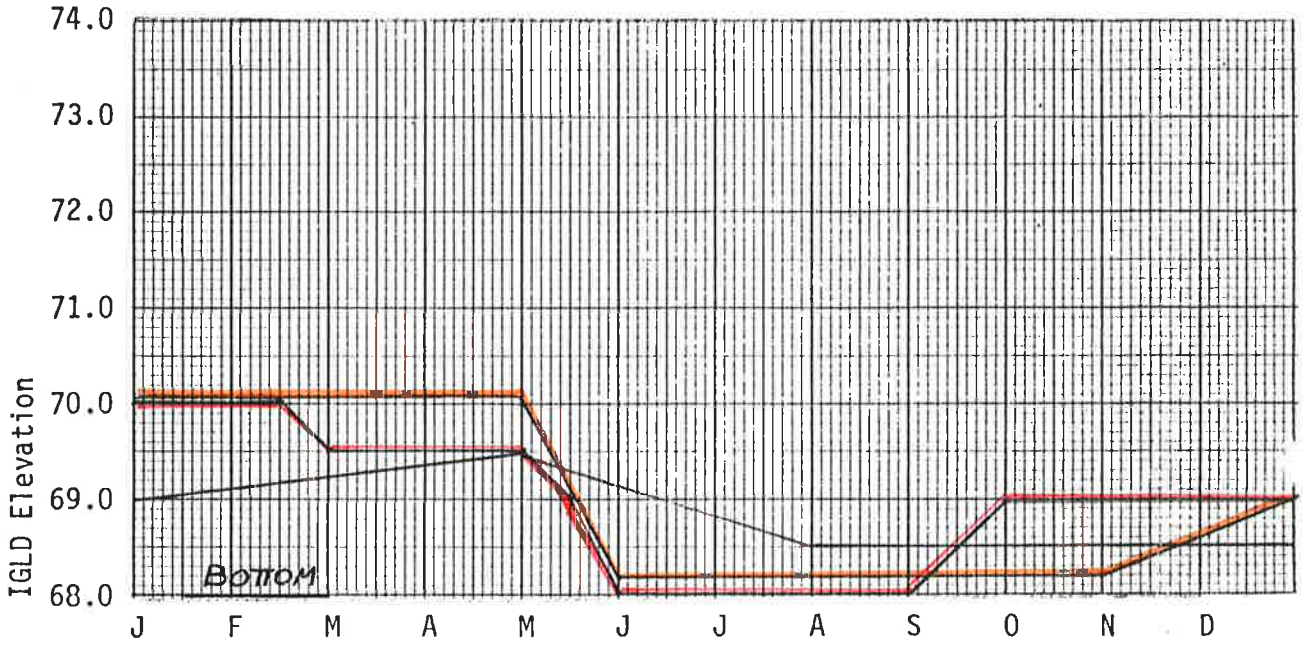
Facilities: Erosion is a serious problem on the north and west dikes with only a moderate problem on the south and east banks. Channels need to be created that will draw water to one location for pumping. The WCS on the east dike is located too high to be of much use.

Costs: Pumping costs by Crisafulli were about $700.

B.2 Objectives of the 1987 Proposed Water Levels

A complete drawdown for dike repairs and to create pump channels. Annual plant production should be excellent on those areas not dried last year. The loosestrife problem will get worse.

1. Unit Pool 2b
2. Acres 95
3. Maximum elevation permissible 572
4. Flowline elevation of lowest structure 570
5. Elevation of general pool bottom 568
6. Water levels: 86 Planned, 86 Actual, 87 Planned



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Cattail	1	1	2
Willow	8	8	8
Smartweed/Millet	6	62	40
Open Water/Cottonwood Seedlings	85	8	40
Smartweed/Cottonwood Seedlings	0	21	10

8. Wildlife Use:

	Use Days 19 84	19 85	19 86
Ducks	2,000	60,000	20,000
Geese	2,000	35,000	20,000
GBH	100	15,000	3,000

9. Map: No map - photo 8/15/87

10. Purple Loosestrife: None noted.

Pool 2b

A.2 Effects of Past Year's Water Levels

Levels: Water levels were per the plan until fall when less water was added and added later than planned due to construction. Several inches of water was left in the deeper bay area to kill cottonwood seedlings. Precipitation kept the lower areas wet through the summer and slowly raised levels in fall.

Results: Excellent stands of millet/smartweed developed in several areas and the levels in the lower areas reduced the cottonwood problem. With no water other than precipitation added in fall waterfowl use was down over 1985.

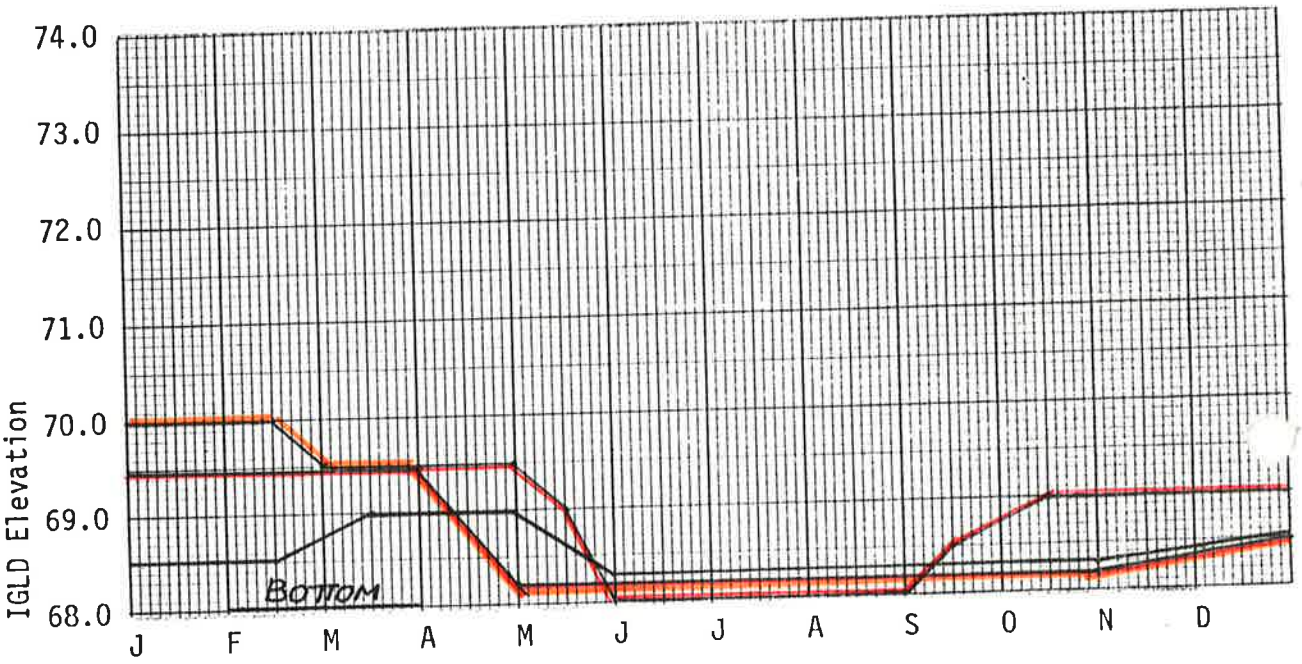
Facilities: Repairs on the south dike were completed. Minor erosion is a problem on the north dike.

Costs: Crisafulli pumping was required in April for one week to lower levels for dike repairs. Estimated costs for pumping were $500.

B.2 Objectives of the 1987 Proposed Water Levels

Water levels will be kept shallow to wet to encourage emergent vegetation and kill cottonwood seedlings. No water will be added by WCS in spring and fall to keep pumping costs down.

1. Unit Pool 2c
2. Acres 80
3. Maximum elevation permissible 571
4. Flowline elevation of lowest structure 567
5. Elevation of general pool bottom 569
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%19 84	%19 85	%19 86
Aquatic Smartweed	3	3	0
Smartweed	0	75	20
Cottonwood Seedlings	0	19	0
Millet/Other	0	0	50
Open Water/Cottonwood Seedling	97	3	30

8. Wildlife Use:

	Use Days 19 84	19 85	19 86
Ducks	1,500	30,000	10,000
Geese	1,500	15,000	20,000
GBH	200	20,000	3,000

9. Map: No map - photo 8/15/87

10. Purple Loosestrife: None observed.

Pool 2c

A.2 Effects of Past Year's Water Levels

Levels: Water levels were lowered by pumping in April. The unit was dry except for the NW lower areas which were left flooded to kill cottonwood seedlings. No water was added via WCS and precipitation partially filled the unit in fall.

Results: Smartweed/millet response was moderate with excellent stands developing along the margin of the deeper bay. A mixture of millet and other less desirable mudflat species developed over ½ the unit. Cattail seedlings were noted around the margins of the bay.

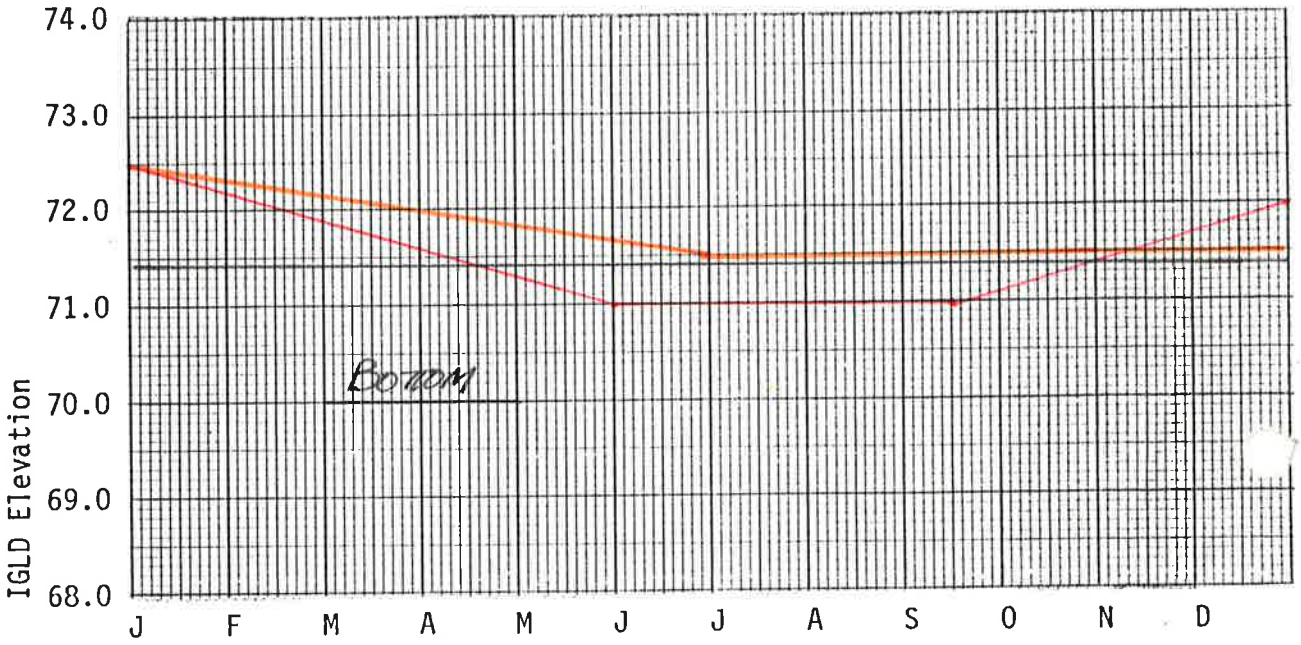
Facilities: Only a 300' section of the south dike still requires re-sloping and rip-rap and will be completed in 1987.

Costs: Crisafulli pumping for one week at about $500.

B.2 Objectives of the 1987 Proposed Water Levels

Drawdown by pumping only to the point where the access to the south dike bank is dry. The deeper bay will remain flooded to kill cottonwood seedlings. Declining annual plant production is expected. Cattail seedlings should take off.

1. Unit Pool 6
2. Acres 160
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 569
5. Elevation of general pool bottom 570
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned———



7. Vegetation: Marsh Successional Stage(1-5) 3

Species	%1984	%1985	%1986
Open Water	40	45	50
Wooded	10	10	10
Cattail	50	45	40

8. Wildlife Use:

	Use Days 1984	1985	1986
Unknown			

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: None observed.

Pool 6 (Woodie's Roost)

A.2 Effects of Past Year's Water Levels

Levels: Water levels were kept as stable as possible during the year by letting in water when lake levels permitted. The lack of automatic flow structures into this unit severly hampers the management of the unit as all water flow must be closely monitored and twice daily adjustments made to the structure setting. In addition, breaks and rat holes in dikes do not allow for precise management.

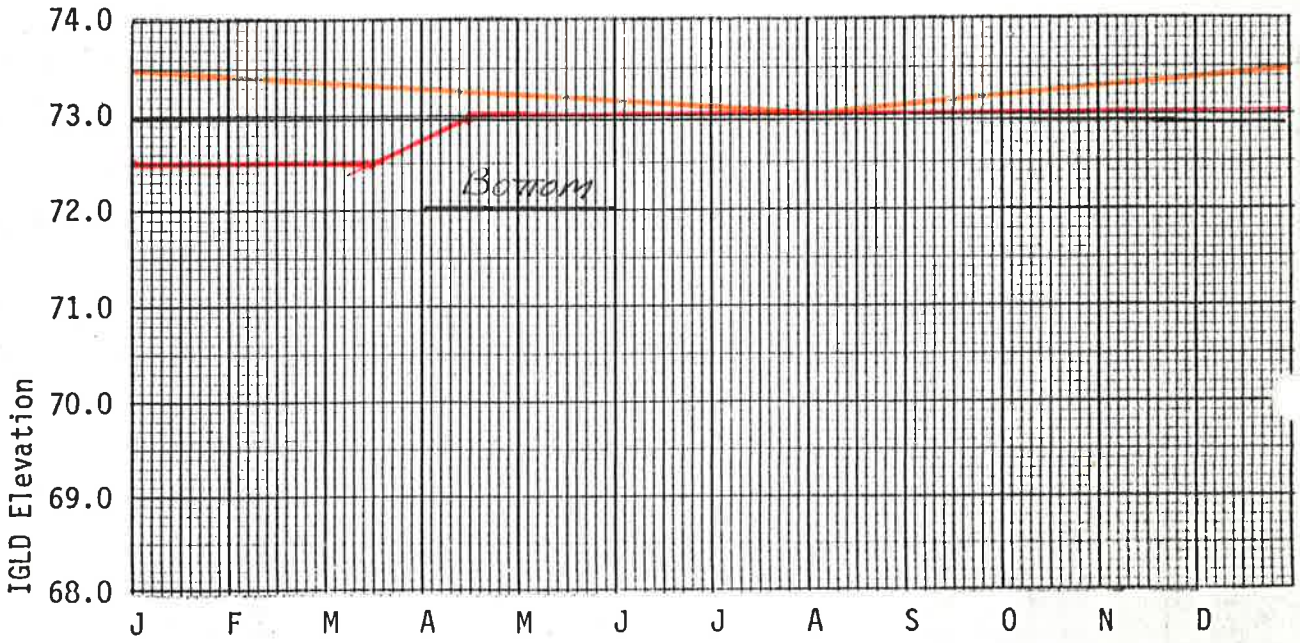
Results: Muskrats took advantage of the increased water levels and opened up dense cattail areas. There was a several fold increase in rat houses noted.

Facilities: A detailed evaluation of the condition of the dikes has not yet been done. Some erosion of the north dike is a problem.

B.2 Objectives of the 1987 Proposed Water Levels

Water will be held stable in this unit during the year. The degree of management will depend on the degree that the dikes will hold water. Dike repairs for Pool 6 are not possible in 1987. Water levels in this unit depends upon water levels in the adjacent state wildlife area as water must come through the state area. Currently, the state must raise the level of their canal before we can take on water.

1. Unit Show Pool
2. Acres 30
3. Maximum elevation permissible 573.5
4. Flowline elevation of lowest structure 569
5. Elevation of general pool bottom 572
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 2

Species	%1984	%1985	%1986
Open Water	16	16	20
Cattail/Bulrush	10	10	20
Wet Medow	64	64	30
Cottonwood	10	10	10
Submergents	0	0	20

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	1,000	1,000	5,000
Geese	1,000	3,000	3,000
GBH	500	500	1,500

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: Scattered plants throughout unit sprayed.

Show Pool

A.2 Effects of Past Year's Water Levels

Levels: Water levels were kept as stable and high as possible during the entire year. A slight drop in levels in late summer was due to gradual evaporation.

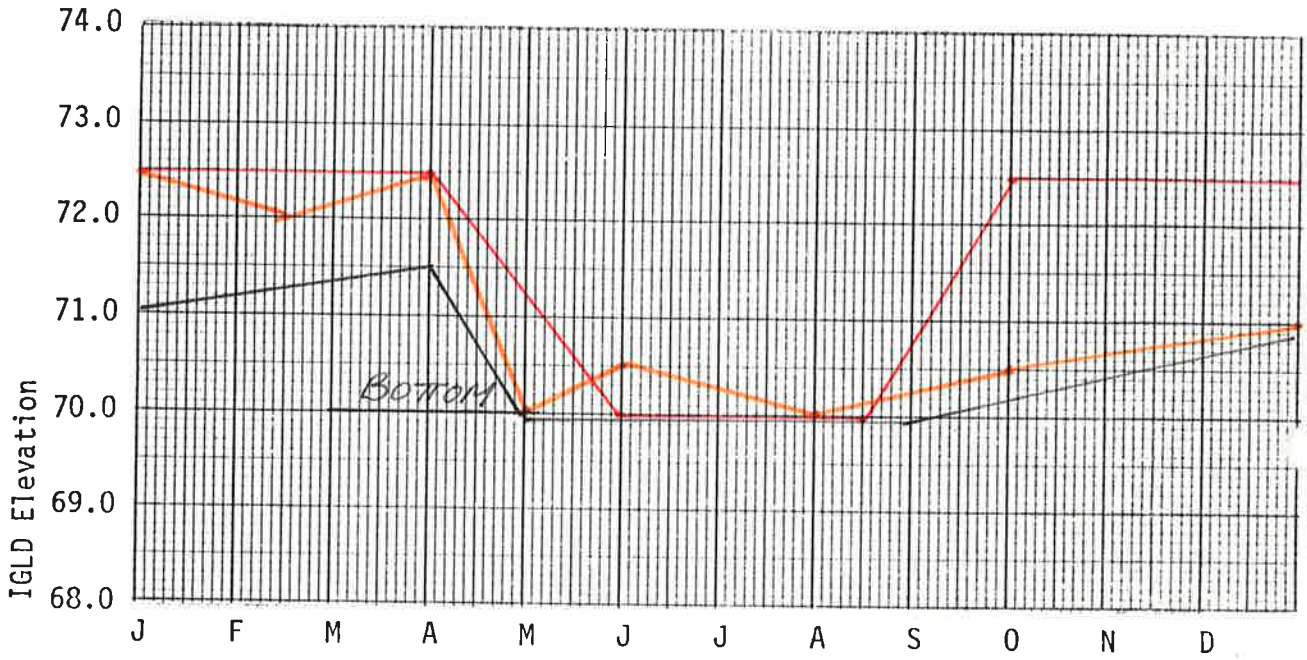
Results: The objective of killing and stressing cottonwood and willow was partially successful. Although no willow was killed, cottonwoods did show signs of stress. Grey stemed dogwood throughout the unit were killed. Cattail and blue joint grass stands were opened up with good diversity present. High levels in the show pool forced high water on the forests adjacent to the office, causing considerable pumping to keep them dry.

Facilities: A 100' section of the N dike is moderately eroded as is sections of the E dike. Leaks through the S dike kept the trees around the shop and office flooded too long in summer. Pumping costs to keep these woods dry - $200.00.

B.2 Objectives of the 1987 Proposed Water Levels

Water levels will be kept high (but slightly less than 1986) and stable to continue stress on cottonwood. Excellent brood habitat will be available and access for loosestrife control will be good due to the high levels.

1. Unit Headquarters Pool
2. Acres 30
3. Maximum elevation permissible 572.5
4. Flowline elevation of lowest structure 570
5. Elevation of general pool bottom 570
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned——



7. Vegetation: Marsh Successional Stage(1-5) 2

Species	%1984	%1985	%1986
Open Water	33	33	10
Cattail	33	33	35
Wet Medow	34	34	35
Smartweed	0	0	20

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	4,000	4,000	15,000
Geese	20,000	20,000	20,000
GBH	2,500	2,500	3,500

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: Moderate infestation along wetland margin sprayed.

Headquarters Pool

A.2 Effects of Past Year's Water Levels

Levels: Constant breaks in the north dike required the unit be drawn-down. The unit was kept dry through summer with pumping required after several rains.

Results: Excellent annual plant production was noted as this was the first drawdown in many years. Shorebird and wading bird use was excellent. The purple loosestrife problem along the east margin expanded.

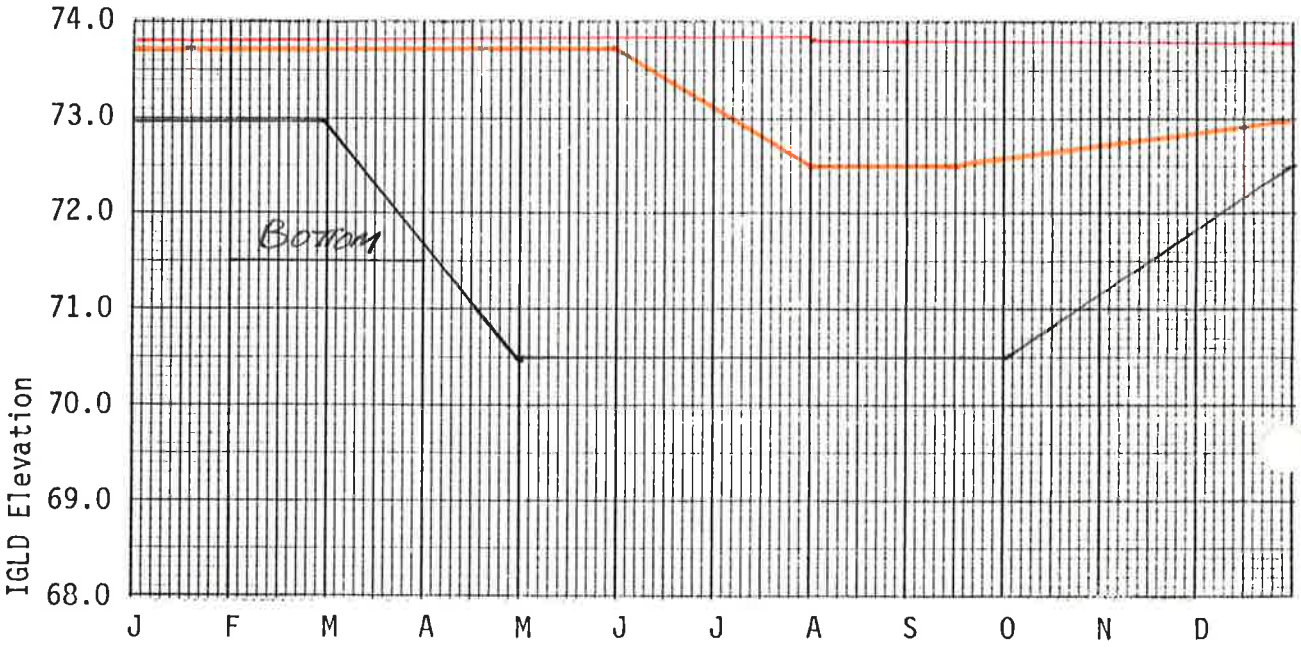
Facilities: The north dike reached the point of being breached with each high rise of the lake. The WCS was rusted out and replaced. Repairs to the N dike were 70% completed.

Costs: Pumping costs by Ford pump - $400.00.

B.2 Objectives of the 1987 Proposed Water Levels

Drawdown in April to complete dike repairs and to rip-rap N & W dikes. Once repairs are completed permit precipitation to slowly build up levels until fall and then partially fill.

1. Unit MSU-3
2. Acres 213
3. Maximum elevation permissible 574.5
4. Flowline elevation of lowest structure 567
5. Elevation of general pool bottom 571.5
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned——



7. Vegetation: Marsh Successional Stage(1-5) 3

Species	%1984	%1985	%1986
Emergents	50	70	70
Open Water	15	10	10
Smartweed/Millet	25	5	5
Bidens/Cottonwood	10	15	15

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	800,000	650,000	500,000
Geese	200,000	225,000	100,000
GBH	6,000	4,000	5,000

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: Scattered first year plants throughout the unit. Not sprayed due to problems locating small plants.

A.2 Effects of Past Year's Water Levels

Levels: Water was held as high as possible through the early summer months with leaks developing in the E and N dikes. Levels were near 574 in early summer but gradually dropped to 572.5 by August. The unit was gravity and pump filled in September.

Results: The unit has developed into an excellent emergent marsh with cattail, burreed, bulrush well interspersed in the south, Central, east and north sections. Bidens was the predominate mudflat species present. Cottonwood and loosestrife are getting to be a problem on most higher ground. Higher levels created ideal muskrat conditions with a big increase in houses noted.

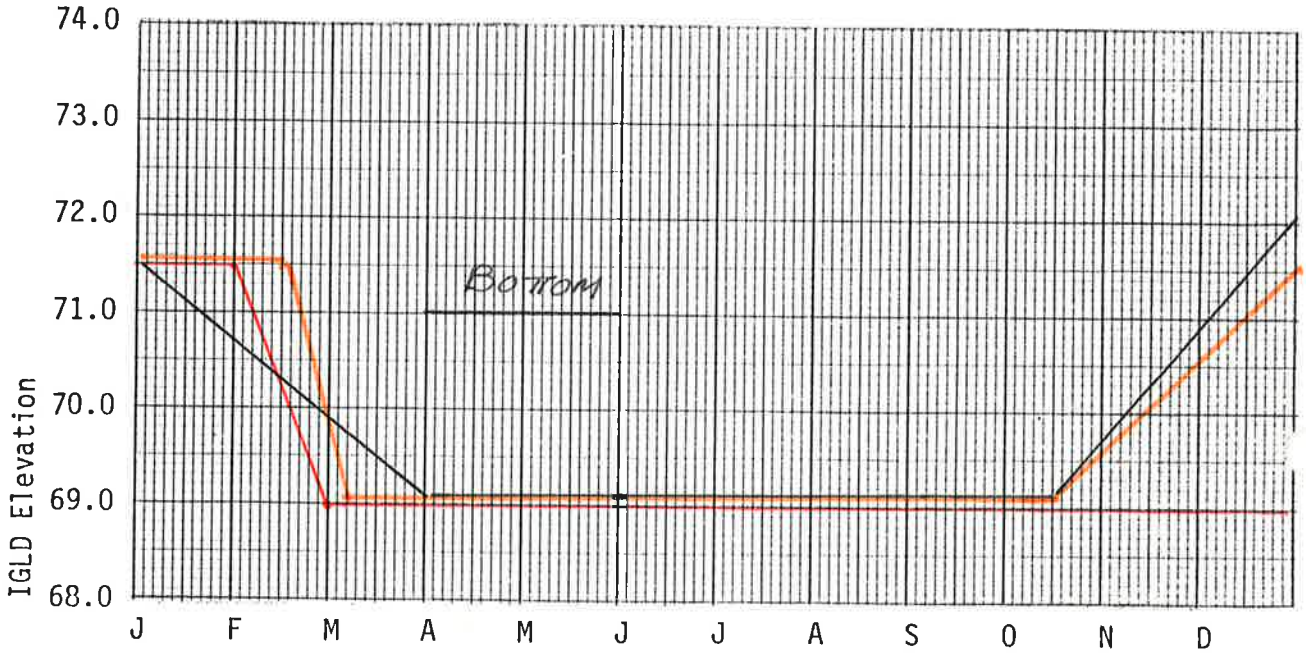
Facilities: The north dike along Tank Ditch is nearing the end of it's functional life. It is just about too narrow to drive equipment down to repair muskrat holes. One high lake rise could cause a break that could not be repaired.

Costs: Estimated electric pumping costs $600.00

B.2 Objectives of the 1987 Proposed Water Levels

Drawdown to dry as possible in March and burn, disk, and plant buckwheat or millet in August. There has been no mechanical disturbance since 1983 and action is needed if the unit is to be returned to high quality moist soil plant production instead of an emergent marsh. Cottonwood and loosestrife will become increasingly serious problems if not controlled in 1987. Another year of mechanical disturbance will be again required in 1988 to complete return to moist soil production. Partially flood in fall for waterfowl use.

1. Unit MSU-4
2. Acres 106
3. Maximum elevation permissible 574
4. Flowline elevation of lowest structure 567
5. Elevation of general pool bottom 571.5
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Reed Canarygrass/Willow	60	65	3
Cattail/Willow	15	20	1
Millet/Bidens/Smartweed	25	15	1
Agriculture	0	0	90
Borrow	0	3	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	15,000	20,000	5,000
Geese	20,000	25,000	150,000
GBH	500	500	100

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: None noted.

MSU-4

A.2 Effects of Past Year's Water Levels

Levels: The unit was drawdown in February and kept dry until late fall when precipitation filled the ditches and flooded lower lying areas.

Results: Objectives for the year was to eliminate the reed-canarygrass, willow, and cattail invasion that had just about claimed the entire unit. The unit was burned in April and plowed once, disked three times and planted to Japanese millet in August. Sprouts of willow and reed-canarygrass were common scattered throughout the unit in September.

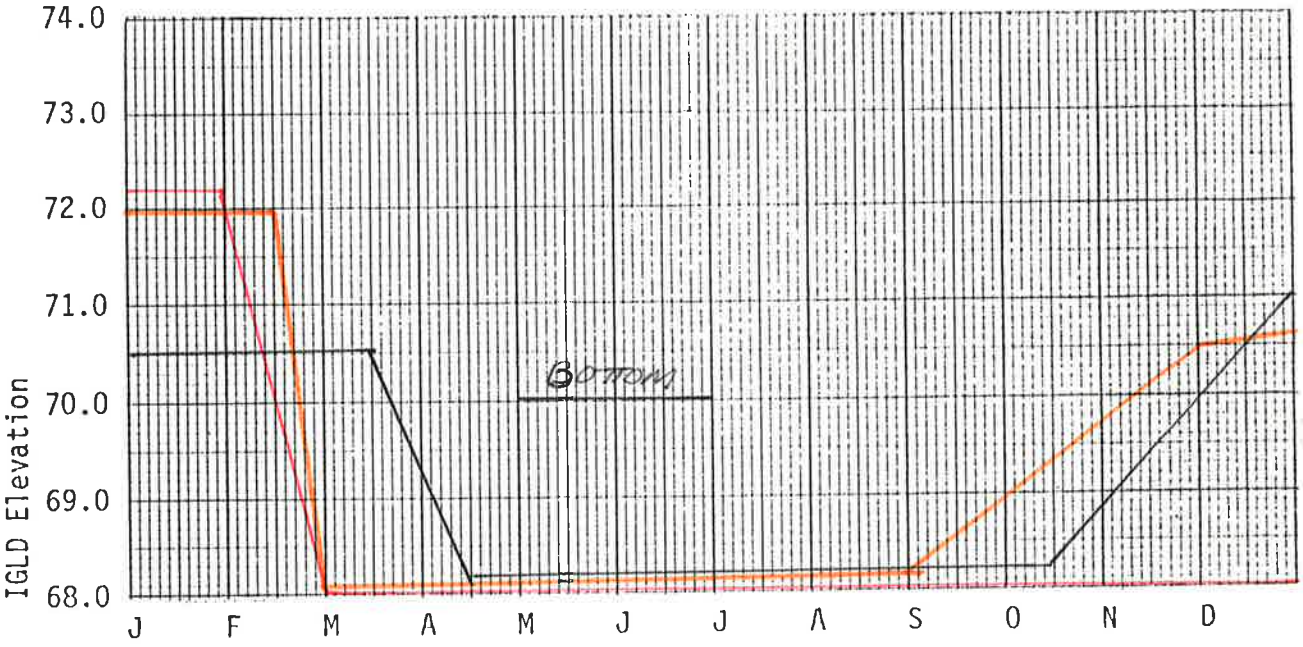
Facilities: About ½ of the W MSU-3-4 common dike were repaired on the MSU-4 side. The N & W dikes are in good shape. The remaining ½ of the W dike and the S dike need repairs and rip-rap.

Costs: About 2/3 of the cultivation and all of the planting was done by coop. farmers. The refuge plowed and disked about 30 acres separate of the cooperators areas. Total cost for disturbance, pumping and burning - $1,000 (700 soil, 100 pumping, and 200 burning.)

B.2 Objectives of the 1987 Proposed Water Levels

Elimination of all woody/reed-canarygrass sprouts in the ground by cooperative farming of the entire unit. Planting of soybeans and sorghum with fall plowing of all soybeans acres should come close to elimination of the sprouts. All edges and corners containing reed-canarygrass will be sprayed with Roundup. Only herbicides with no carryover problems will be used.

1. Unit MSU-5
2. Acres 250
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 567
5. Elevation of general pool bottom 570.5
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Millet/Smartweed	55	15	30
Agriculture	0	0	30
Bidens	5	45	5
Cattail/reed canarygrass	5	5	5
Cottonwood/willow	35	35	30

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	250,000	450,000	100,000
Geese	150,000	240,000	300,000
GBH	1,000	2,500	1,000

9. Map: No map - Photo 8/15/86

10. Purple Loosestrife: None noted.

A.2 Effects of Past Year's Water Levels

Levels: The unit was drawndown in February and kept dry until fall when it was partially filled by gravity for waterfowl use.

Results: Objectives were to eliminate willow, cattail, reed-canarygrass invasion that was taking over the entire unit. The unit was disked three times and planted to 160 acres of corn. A wet June and poor drainage drown approximately 80 acres. Excellent stands of common millet developed in several areas which were well used by geese and ducks. Heavy willow sprouts were mowed in late August. Willow sprouts were found throughout the standing corn and were most visible after the corn was picked in October.

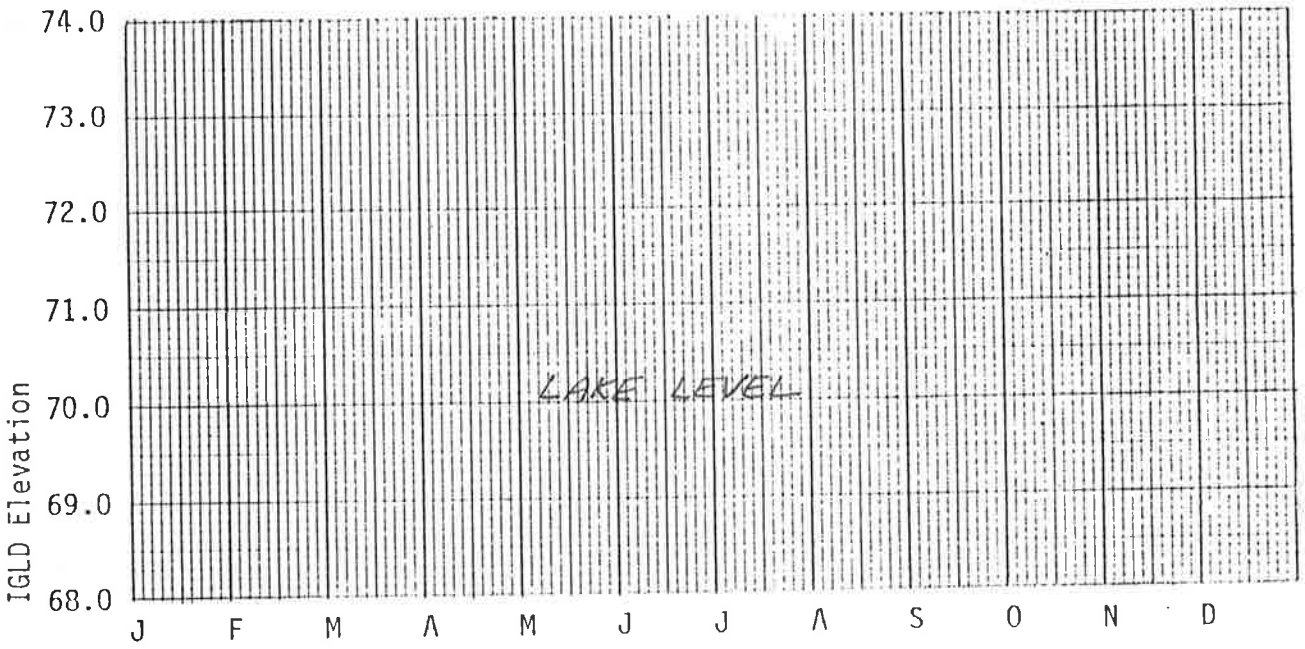
Facilities: All facilities are in good shape except the south slope of the N dike needs rip-rap. The east dike is marginal as far as height during this high water period.

Costs: Mowing of willow was accomplished by volunteers with tractor costs estimated at $200. Pumping costs were $300.

B.2 Objectives of the 1987 Proposed Water Levels

Cooperative farm the entire unit with 120 acres of soybeans, 20 acres of buckwheat and 20 acres of sorghum planted to eliminate willow/reed-canarygrass problem. Use only herbicides with no carryover problems. Plow all ground in spring and disk at least 3 times before planting. Fall plow beans. Spray with Roundup all edges and corners containing reed-canarygrass and willow.

1. Unit MSU-6
2. Acres 70
3. Maximum elevation permissible Varies with lake
4. Flowline elevation of lowest structure None
5. Elevation of general pool bottom 571.5
6. Water levels: 86 Planned , 86 Actual , 87 Planned



7. Vegetation: Marsh Successional Stage(1-5) 2

Species	%1984	%1985	%1986
Cottonwood/Willow	35	35	35
Other Upland	10	10	10
Cattail	50	50	50
Other	5	5	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Duck	1,000	1,000	5,000
Geese	100	100	1,000

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: None noted.

MSU-6

A.2 Effects of Past Year's Water Levels

Levels: No actual water control is possible due to eroded dikes which allow the area to fluctuate with the lake.

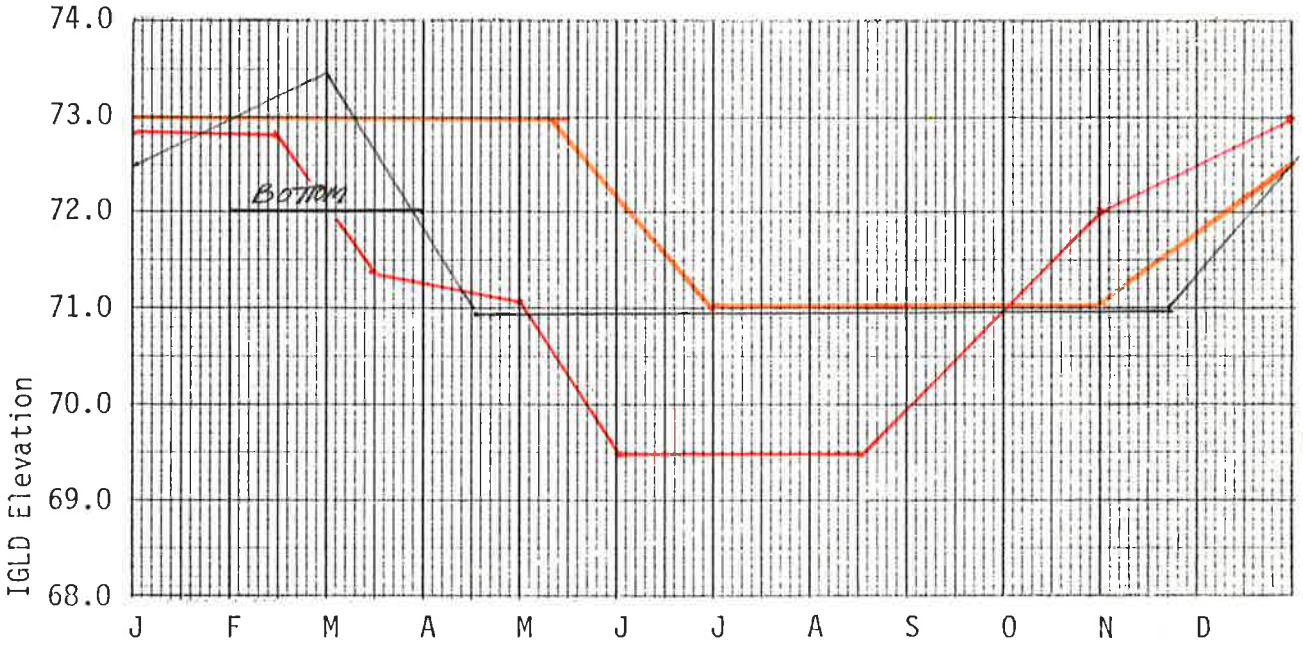
Results: Higher lake levels have provided improved muskrat habitat and the muskrats riddled the dense cattails with cabins.

Facilities: Both the north and south dikes need complete rebuilding to make this a functional unit. Minor extension of inlet/outlet culverts to the moist soil pump are all that's needed to provide active water level control.

B.2 Objectives of the 1987 Proposed Water Levels

None

1. Unit MSU-7A
2. Acres 49
3. Maximum elevation permissible 573.5
4. Flowline elevation of lowest structure 570.5
5. Elevation of general pool bottom 572.0
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%19	%19	%19
Upland Species	55	40	20
Cattail	10	5	5
Millet	10	10	30
Bidens	20	40	40
Smartweed	5	5	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	20,000	15,000	20,000
Geese	15,000	10,000	30,000
GBH	1,000	1,500	1,000

9. Map: No map - photo 5/15/86

10. Purple Loosestrife: A few scattered plants sprayed.

MSU-7A

A.2 Effects of Past Year's Water Levels

Levels: Water levels were held up until mid-May and drawndown to dry by early June. Construction in fall of Stange Road bridge access required the unit be kept dry in fall. Precipitation gradually filled the unit in early winter.

Results: Succession replaced many annual plants with swamp milkweed, aster and cocklebur becoming dominant in several areas. Mowing in July removed the overtopping species and permitted the common millet below to produce a fair crop of seed.

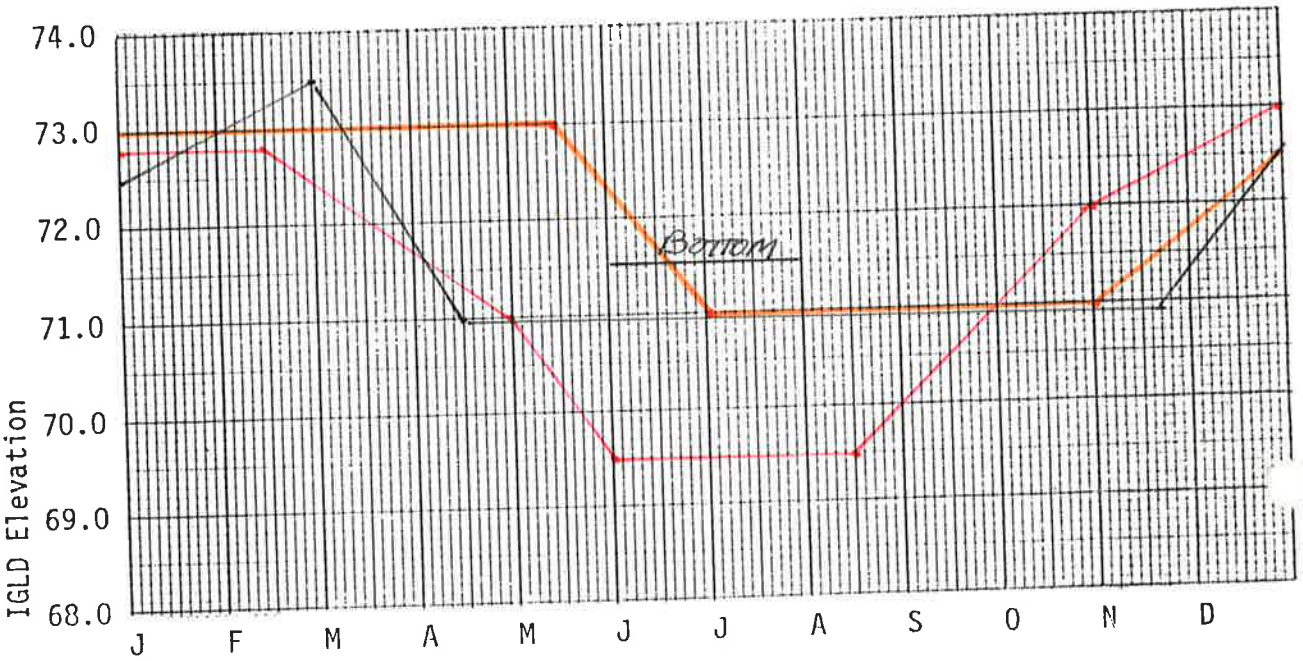
Facilities: The N dike is eroding rapidly due to the high lake levels. Repairs of resloping and rip-rap will be required within two years before the dike is totally eroded. The pump ditch also is in need of cleaning to remove silt.

Costs: The unit was pumped dry using an 8" electric farm pump at a cost estimated at $300.00.

B.2
Objectives of the 1987 Proposed Water Levels

Drawdown to complete bridge access repairs and mowing to encourage millet if other species overtop desirable species.

1. Unit MSU-7B
2. Acres 44
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure None
5. Elevation of general pool bottom 571.5
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Upland	34	27	35
Aquatic Smartweed	11	11	10
Smartweed/Millet	11	11	15
Bidens	34	14	30
Agricultural/Millet	0	27	0
Cottonwood/Willow	10	10	10

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	20,000	12,000	10,000
Geese	20,000	20,000	15,000
GBH	1,000	1,000	500

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: A few scattered plants sprayed.

MSU-7B

A.2 Effects of Past Year's Water Levels

Levels: Water levels were held up until mid-May and drawndown to dry by early June. Construction in fall of Stange Road bridge access required the unit be kept dry in fall. Precipitation gradually filled the unit in early winter.

Results: Cocklebur and bidens were the dominate species in the lower areas with aster dominate on higher ground. The N-central area developed dense aquatic smartweed stands. No mowing was accomplished.

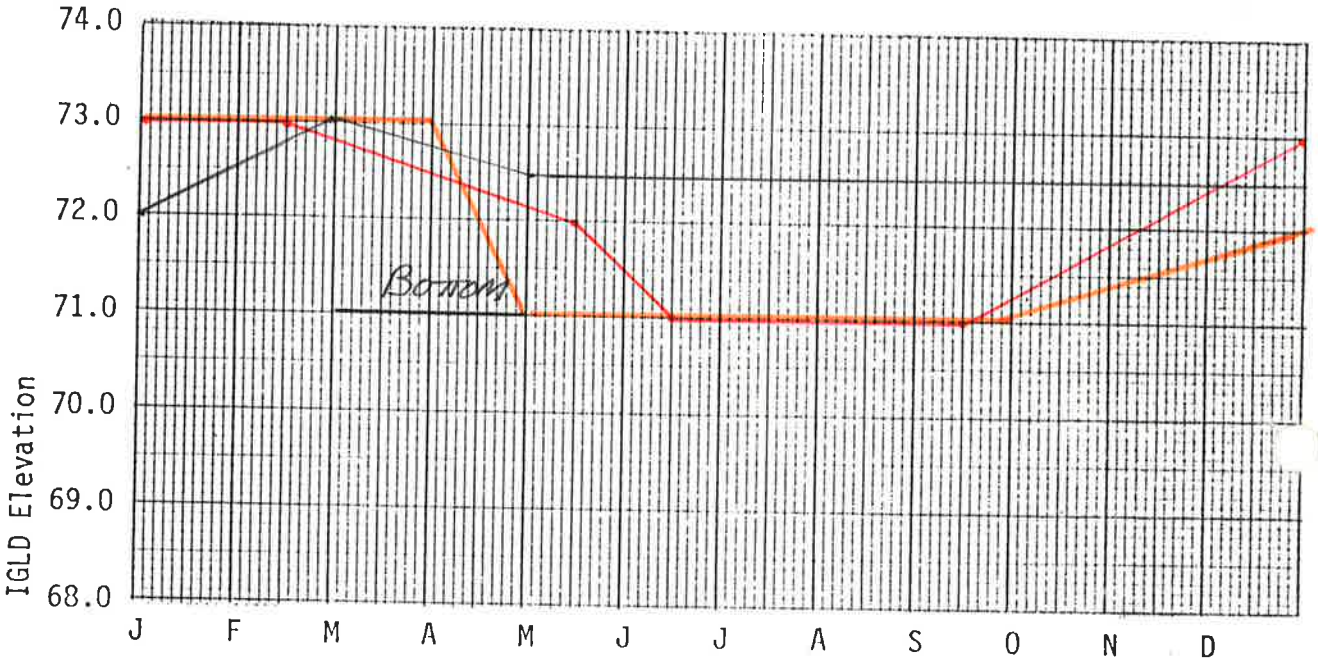
Facilities: The N dike requires resloping and rip-rap. The west common dike with MSU-7A is non functional and 7B is managed with 7A.

Costs: Included in 7A costs.

B.2 Objectives of the 1987 Proposed Water Levels

Drawdown to complete access repairs and mowing to encourage millet.

1. Unit MSU-8A
2. Acres 44
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 570
5. Elevation of general pool bottom 571.5
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Agricultural (Buckwheat)	0	64	0
Millet/smartweed	11	26	40
Bidens	47	2	30
Cottonwood seedlings	32	0	20
Upland Spp	10	0	10

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	80,000	100,000	120,000
Geese	30,000	40,000	30,000
GBH	2,000	1,000	1,000

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: None noted.

MSU-8A

A.2 Effects of Past Year's Water Levels

Levels: The unit was dried up in April and kept dry until October. Wetter lower areas remained wet into June.

Results: Cottonwood, cocklebur and bidens dominated much of the lower areas of the unit with aster and milkweed dominate on the higher ground. The entire unit was mowed in mid-July to release overtopped millet and foxtail. Response was excellent although all the cottonwood sprouted by fall.

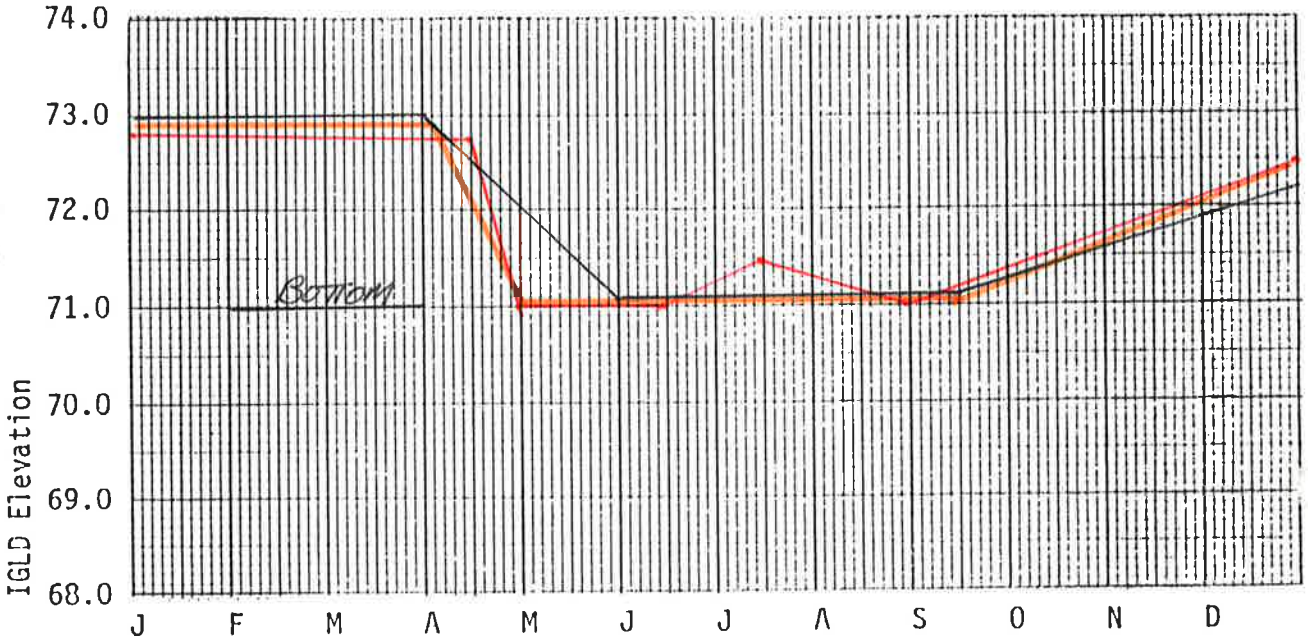
Facilities: The pump unit needs a new housing and other improvements. The SW and W dikes are eroding and in need of repair. The pump well needs to have silt removed to make the pump more functional.

Costs: Electric pum costs - $300.00

B.2 Objectives of the 1987 Proposed Water Levels

Water levels will be kept as high as possible throughout the year to kill small cottonwood seedlings and other upland vegetation.

1. Unit MSU-8B
2. Acres 85
3. Maximum elevation permissible 572.5
4. Flowline elevation of lowest structure 571.5
5. Elevation of general pool bottom 571
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 1

Species	%1984	%1985	%1986
Millet	29	76	70
Bidens	65	6	15
Upland Spp.	6	6	10
Agriculture		12	0
Cocklebur			5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	60,000	150,000	160,000
Geese	90,000	12,000	20,000
GBH	2,000	3,000	2,000

9. Map: No map - Photo 8/15/86

10. Purple Loosestrife: A few scattered plants sprayed.

MSU-8B

A.2 Effects of Past Year's Water Levels

Levels: Drawdown was completed by May 1 with heavy rains in June keeping conditions wet. Gradual increase in levels were started in mid-September with filling completed by mid-October.

Results: Cocklebur and millet dominated wetter areas with scattered cottonwood saplings throughout. Dryer areas contained aster, goldenrod and dock. The entire unit was mowed with excellent millet response.

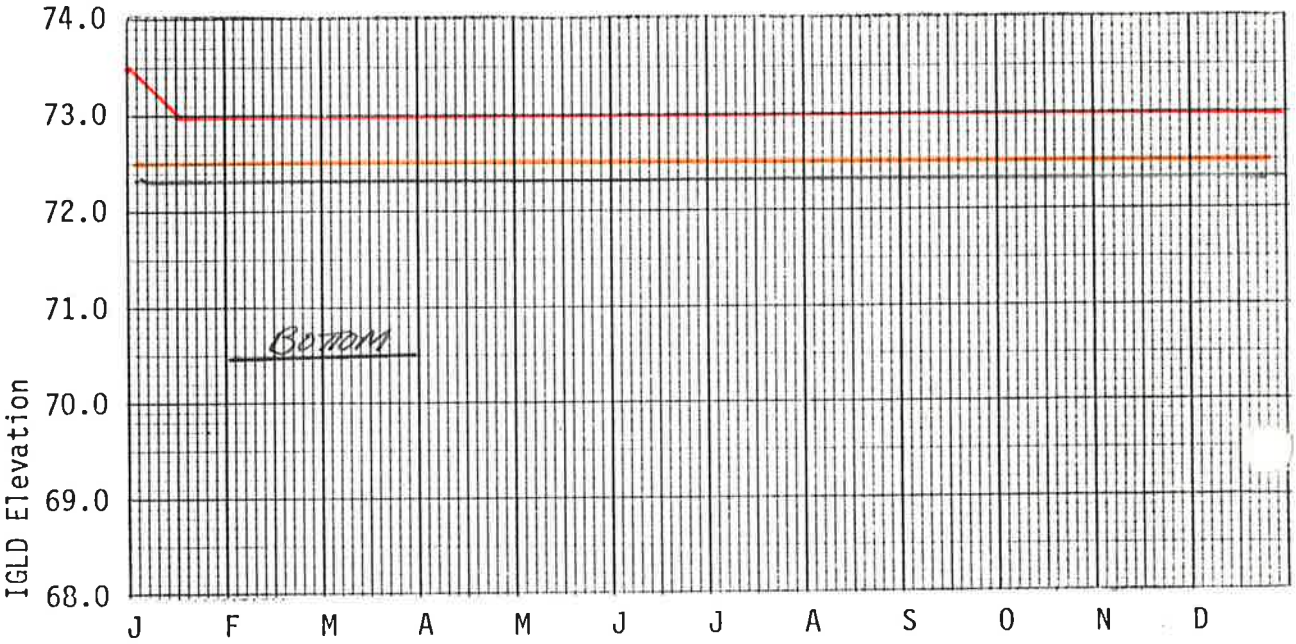
Facilities: Minor erosion is a problem along the N dike. All other facilities are in good shape.

Costs: Pumping costs approximately $300.00. The WCS in the NW corner was replaced at a cost of $600.00 for materials.

B.2 Objectives of the 1987 Proposed Water Levels

Drawdown in late May. Light disking in mid-June of higher sites and cottonwood problem areas to encourage smartweed and discourage cottonwood sprouts.

1. Unit Mini-Marsh
2. Acres 16
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 571
5. Elevation of general pool bottom 570.5
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 4

Species	%19 84	%19 85	%19 86
Open Water	10	10	10
Cattail	80	80	40
Other	10	10	10
Dead Cattail/Submergents	0	0	40

8. Wildlife Use:

	Use Days 19 84	19 85	19 86
Ducks	1,000	1,000	8,000
Geese	500	500	2,000
GBH	400	400	200

9. Map: No map - Photo 8/15/86

10. Purple Loosestrife: None noted.

Mini - Marsh

A.2 Effects of Past Year's Water Levels

Levels: Water levels were held stable and high to open dense cattails through the year.

Results: High water levels have open up ½ of the unit and riddled the remaining cattail. Excellent interspersion was present.

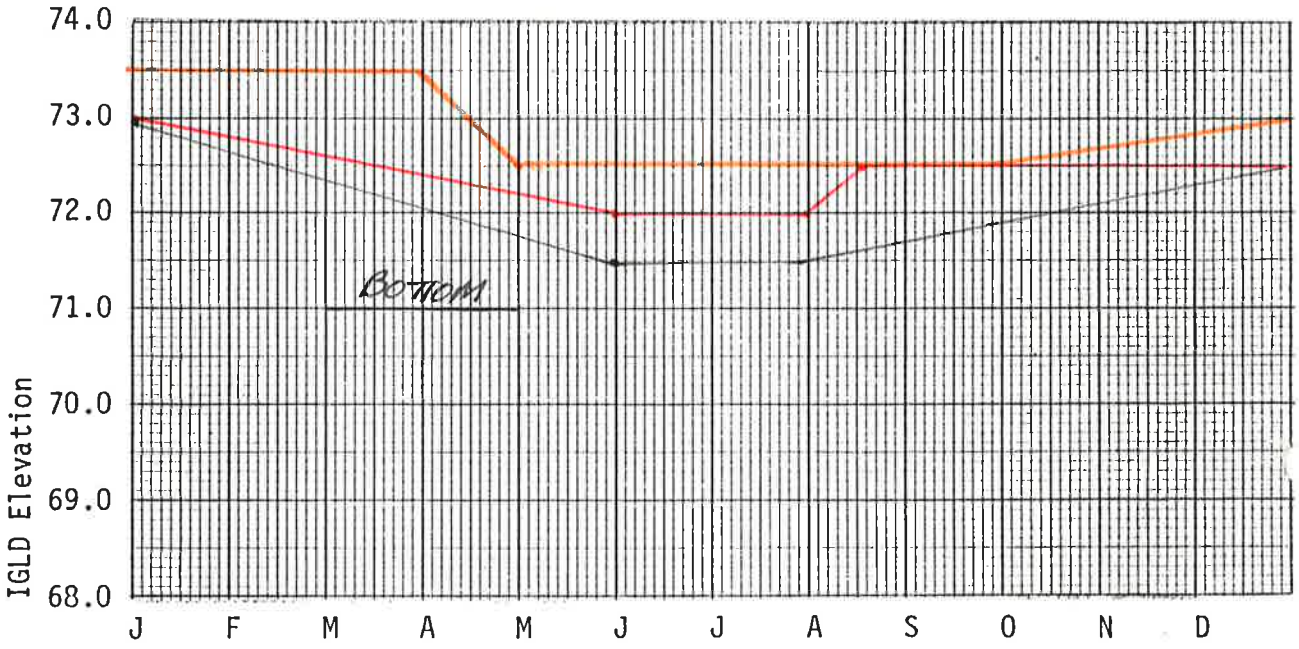
Facilities: The N and E dikes are severely eroded and not safe for vehicle travel. The pump needs repairs and is non-functional. Any pumping is accomplished by portable pump.

Costs: Pumping cost estimate for year was $100.00.

B.2 Objectives of the 1987 Proposed Water Levels

The lack of pumping facilities precludes any significant water management. Levels will be held as stable as possible to continue opening dense cattails. No water will be discharged unless levels begin to cause internal erosion.

1. Unit Cedar Point - Pool 1
2. Acres 1,460
3. Maximum elevation permissible 574
4. Flowline elevation of lowest structure 569.4
5. Elevation of general pool bottom 571
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned———



7. Vegetation: Marsh Successional Stage(1-5) 5

Species	%1984	%1985	%1986
Open Water	25	35	50
Water Lilly	10	15	20
Cattail	30	20	10
Burreed	15	10	5
Other	20	20	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	700,000	800,000	600,000
Geese	140,000	140,000	100,000
GBH	36,000	30,000	15,000

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: Infestation declining throughout pool due to spraying and high water.

Cedar Point - Pool 1

A.2 Effects of Past Year's Water Levels

Levels: Water levels were above planned levels except for a short time in fall. Drainage by gravity was only possible for two days throughout the year.

Results: High water levels have drowned all but the highest emergent stands throughout the unit. As the unit became more open wave action increased and prevented submergents from becoming established. Water lilly continued to expand into areas previously cattail-burreed.

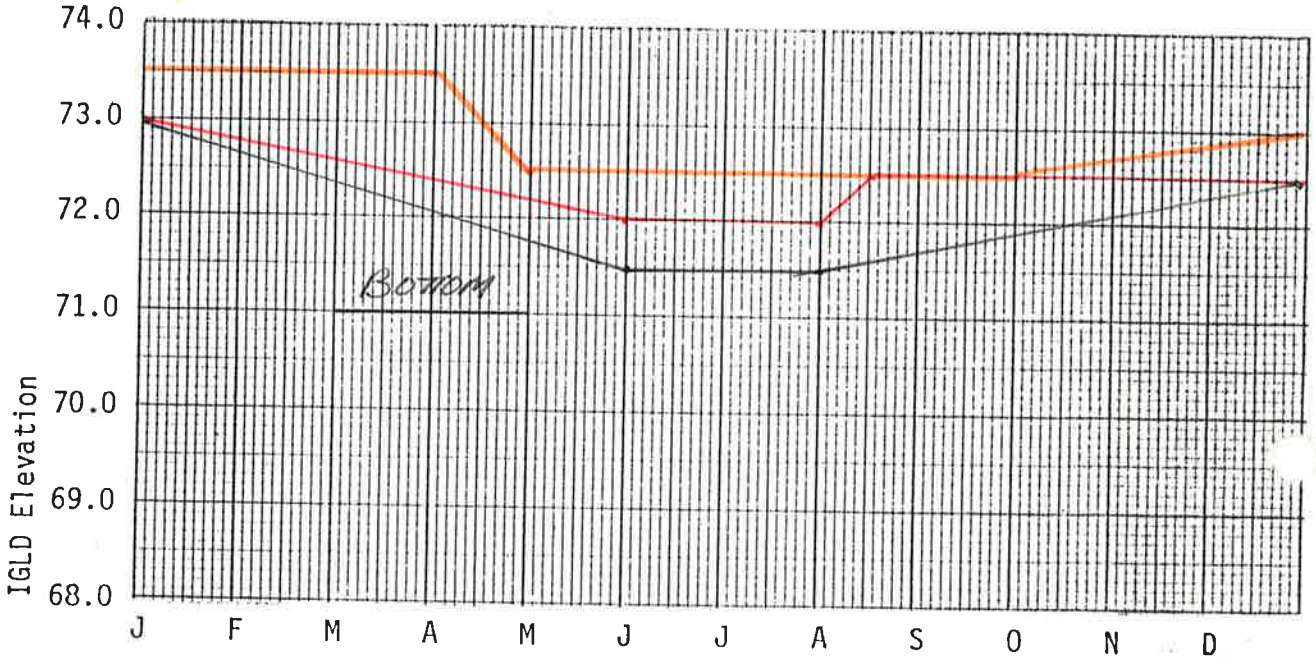
Facilities: High water levels are beginning to cause internal erosion of dikes along the north, southwest and south dikes. The drainage canal between the Pheasant Farm and Pool 1 is severely eroded and damage accelerated during the year. Several miles of road are in need of gravel and become difficult to travel during wet weather.

Costs: All dikes were mowed with one leak repaired in the drainage canal dikes.

B.2 Objectives of 1987 Proposed Water Levels

A partial drawdown will be attempted in a effort to expose the bottom on the higher locations and re-establish emergents. Vegetation is needed to reduce wave action and encourage submergents. If a drawdown is possible purple loosestrife will expand and control efforts will be hampered by low levels.

1. Unit Cedar Point - Pool 2
2. Acres 135
3. Maximum elevation permissible 574
4. Flowline elevation of lowest structure 569.4
5. Elevation of general pool bottom 571
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 4

Species	%1984	%1985	%1986
Open Water	50	60	65
Cattail	35	25	20
Bulrush	5	5	5
Burreed	5	5	5
Other	5	5	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	80,000	50,000	25,000
Geese	20,000	20,000	20,000
GBH	5,000	5,000	5,000

9. Map: No map - photo 5/15/86

10. Purple Loosestrife: Moderate infestation parially sprayed. Will be a priority for spraying in 1987.

Cedar Point - Pool 2

A.2 Effects of Past Year's Water Levels

Levels: Water levels were above planned levels except for a short time in fall. Drainage by gravity was only possible for two days throughout the year. The general pool bottom elevation listed at 571 appears to be in error with the actual elevation probably up to a foot higher.

Results: Recorded levels have caused only slight mortality in cattails around the margins of open bays in the unit. Muskrat activity was high with houses throughout the unit. Submergents were dense in all sheltered bays and around the edge of the largest bay.

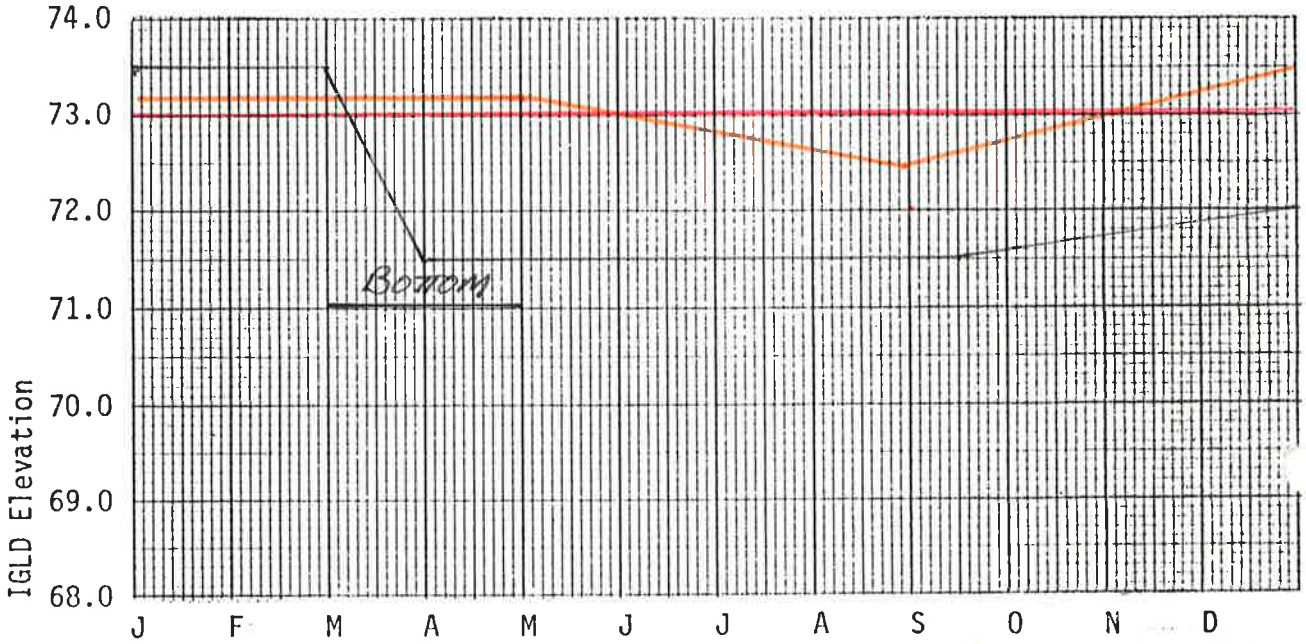
Facilities: The dikes are in good condition with only slight erosion noted.

Costs: Mowing only.

B.2 Objectives of 1987 Proposed Water Levels

Pool 2 is directly connected to Pool 1 and water levels are the same as Pool 1. No WCS currently exists between the two. A partial drawdown planned for Pool 1 should maintain 1986 conditions thru 1987. A lowering of water levels will cause increases in the loosestrife problem.

1. Unit Cedar Point - Pheasant Farm
2. Acres 155
3. Maximum elevation permissible 574
4. Flowline elevation of lowest structure 571
5. Elevation of general pool bottom 571
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned———



7. Vegetation: Marsh Successional Stage(1-5) 5

Species	%1984	%1985	%1986
Cattail	60	50	20
Open Water (Sub. Aquatics)	20	30	70 (35)
Burreed	10	10	5
Arrowhead	10	10	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	150,000	150,000	90,000
Geese	20,000	30,000	20,000
GBH	10,000	10,000	15,000

9. Map: No map - Photo 8/15/86

10. Purple Loosestrife: Infestation declining throughout pool due to spraying and high water.

*Approximately ¼ of bottom exposed at 571.5

Pheasant Farm

A.2 Effects of Past Year's Water Levels

Levels: Water levels were held stable per the plan through the year with several minor deviations due to rainfall and dike breaks between the common State Park dike.

Results: Stable and high water levels have honeycombed the dense cattail of the past few years. Submerged aquatics were dense and interspersed amoung the cattails. Duck use was down considerably due to general declining conditions in the area.

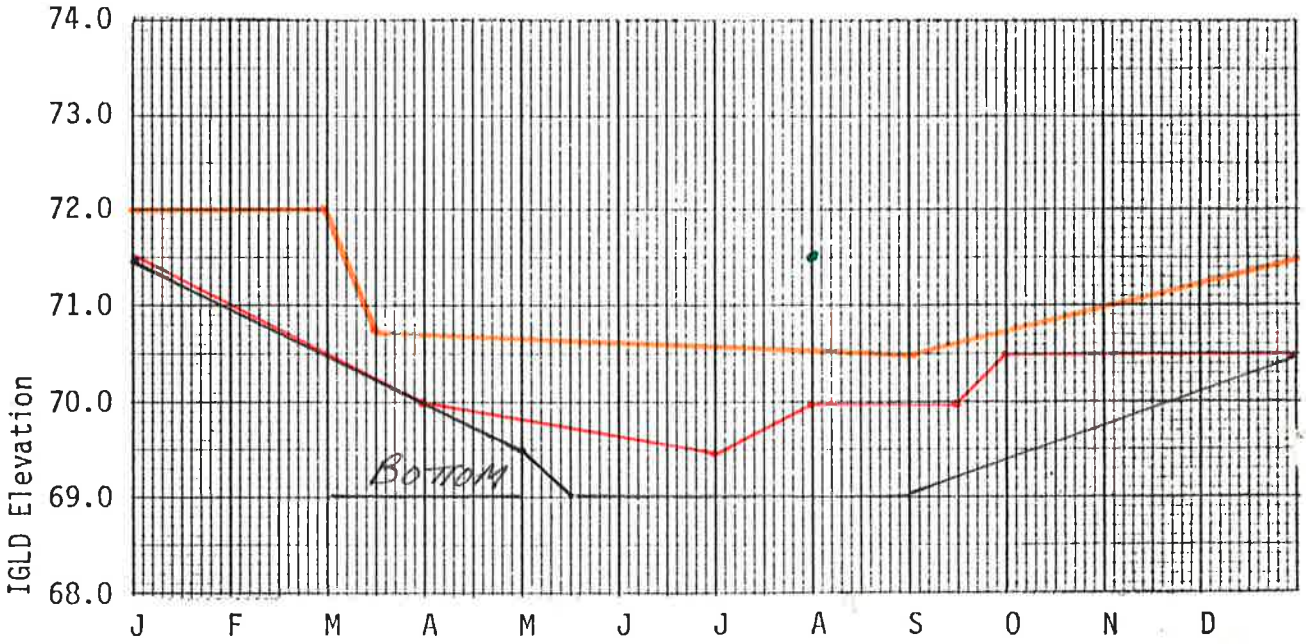
Facilities: The dikes of this unit are in poor condition with both banks of the west and east dikes severely eroded. The south bank is eroded only on the inside and the north dike is in good shape. Rust has rendered the water control structure on the east dike non-functional with it leaking with each rise and fall of the lake.

Costs: All dikes were mowed and two breaks on the west dike were repaired. Erosion is taking a high toll of unprotected dikes.

B.2 Objectives of 1987 Proposed Water Levels

A partial drawdown by Crisafulli pump in March to stop severe internal erosion and to repair rusted out WCS. Water levels to be pumped only to the point needed for repairs and to stop erosion.

1. Unit Darby Pool 1
2. Acres 200
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 566
5. Elevation of general pool bottom 569
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned———



7. Vegetation: Marsh Successional Stage(1-5) 4

Species	%1984	%1985	%1986
Open Water	40	40	50
Waterlilly	10	20	25
Bulrush	15	10	5
Burreed	15	10	10
Cattail, Arrowhead, Other	20	10	10

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	190,000	175,000*	90,000
Geese	80,000	70,000	20,000
GBH	6,000	5,000	8,000

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: Moderate infestation with scattered individual plants and groups noted throughout unit. Plants sprayed within 100' of dike but not by airboat throughout unit.

*Duck peak in 1985 was 17,000 and was 1,200 in 1986.

Darby Pool 1

A.2 Effects of Past Year's Water Levels

Levels: Gravity drainage in spring dropped water levels 1.3' but high lake levels prevented lowering to planned levels. Rainfall through the summer equaled evaporation until fall when levels gradually increased.

Results: Emergent vegetation continued to be stressed but little was lost. Dense stands of submergents were present throughout the unit. Waterlilly continued to dominate areas that were emergents two years ago.

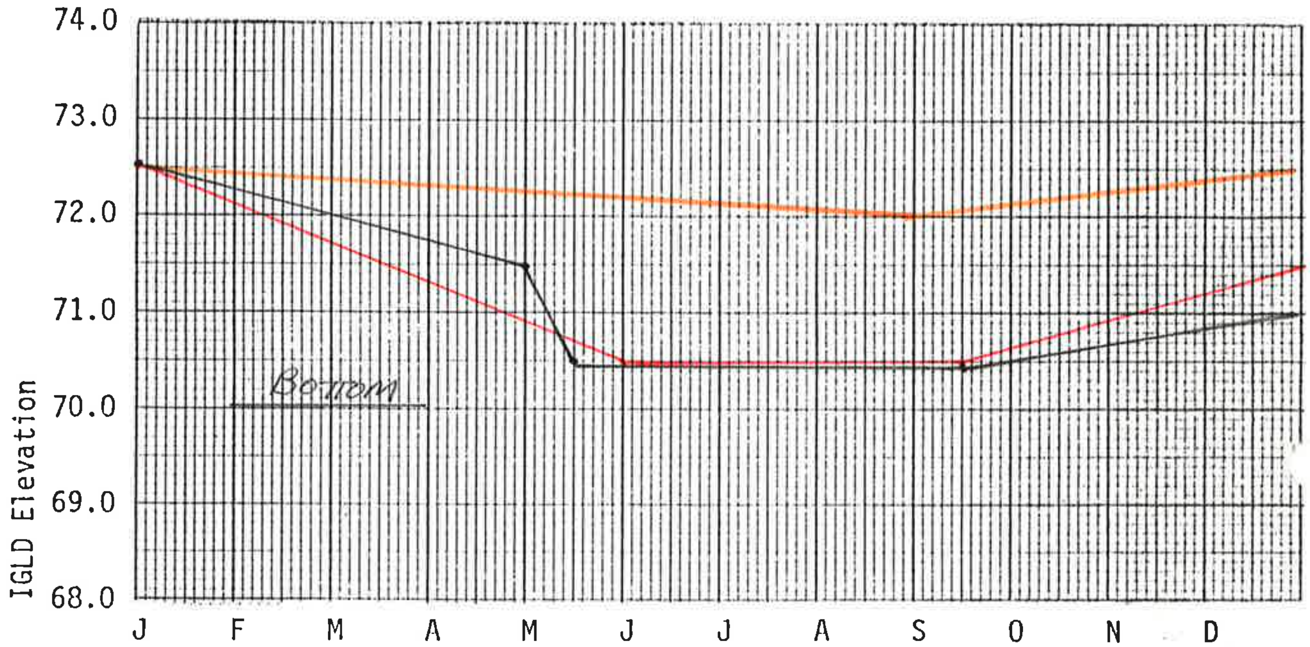
Facilities: The facilities in this unit are in good condition with the exception of the east dike, the east half of the south dike and the south bank of the south dike. All three areas are eroded due to high levels and are not protected by rip-rap.

Costa: All dikes were mowed twice with two breaks repaired with the backhoe. No pumping costs were incurred in 1986.

B.2 Objectives of 1987 Proposed Water Levels

A complete drawdown by gravity drainage if possible by mid-May for annual plant production. Evaluate in mid-June to determine what has germinated. If purple loosestrife seedlings predominate reflood to overtop loosestrife. At a minimum a partial drawdown is needed to maintain what emergents that persist.

1. Unit Darby Pool 2
2. Acres 25
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 569
5. Elevation of general pool bottom 570
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 5

Species	%1984	%1985	%1986
Open Water/Submergents	30	40	40
Dead Cattail/Duckweed	0	40	55
Cattail	60	10	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	15,000	10,000	7,500
Geese	1,000	1,000	3,000
GBH	500	500	2,000

9. Map: No map - photo 8/15/87

10. Purple Loosestrife: Moderate infestation with scattered plants and groups throughout unit. Plants sprayed along dikes.

Darby Pool 2

A.2 Effects of Past Year's Levels

Levels: Water levels were higher than planned throughout the year. Drainage into the unit from adjacent farmland kept levels high even though some gravity drainage did occur.

Results: Emergent vegetation is almost gone. Duckweed in the dead cattail attracted several hundred teal in fall. Dense submergents were present over much of the area.

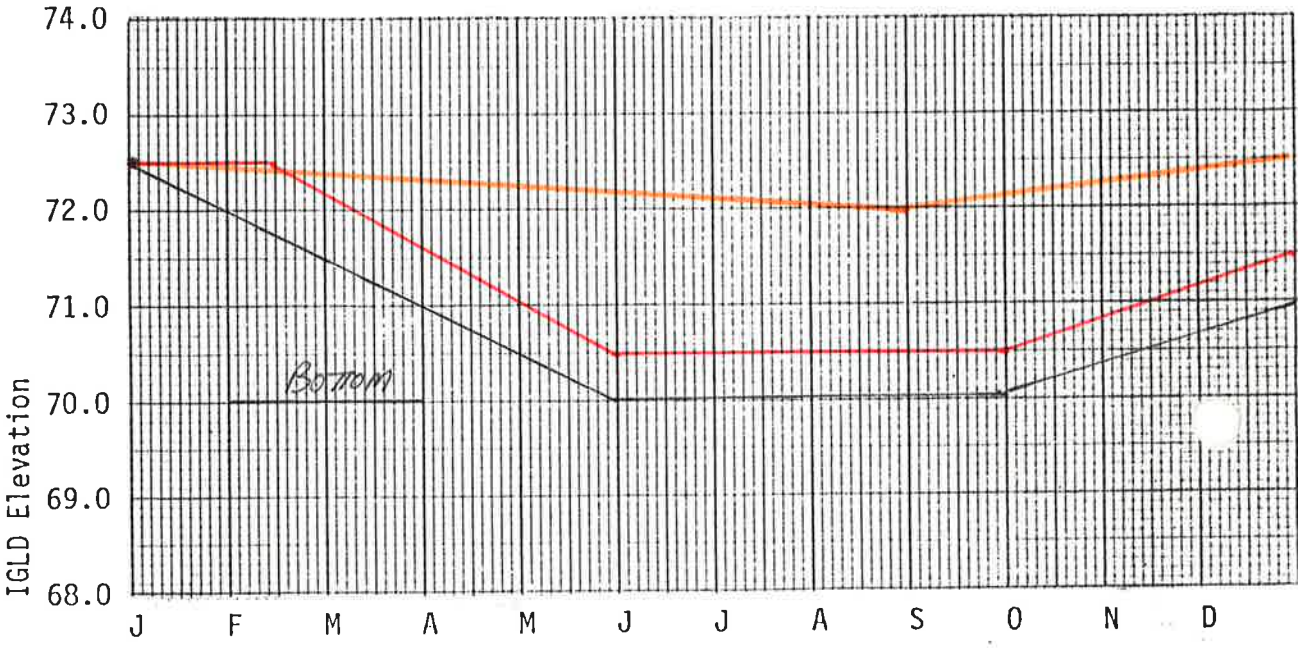
Facilities: Dikes along the west and south sides are in good shape. Both slopes on the north and east dikes are eroded and without rip-rap protection.

Costs: Dikes were mowed twice and no pumping costs were incurred.

B.2 Objectives of 1987 Proposed Water Levels

A partial drawdown by mid-May for annual plant production an to re-establish emergents. Evaluate after drawdown to determine loosestrife germination. Doubtfull if drawdown is possible due to high lake levels.

1. Unit Darby Pool 3
2. Acres 25
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 569
5. Elevation of general pool bottom 570
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned——



7. Vegetation: Marsh Successional Stage(1-5) 5

Species	%1984	%1985	%1986
Open Water	80	90	97
Aquatic Smartweed	10	5	1
Other	10	5	2

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	10,000	10,000	1,000
Geese	2,000	2,000	1,500
GBH	200	200	500

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: A few plants present on cross dike sprayed.

Darby Pool 3

A.2 Effects of Past Year's Water Levels

Levels: Water levels were well above those planned with runoff from adjacent private lands preventing any drawdown.

Results: All emergents are gone with the exception of small aquatic smartweed stand. No submergents were present.

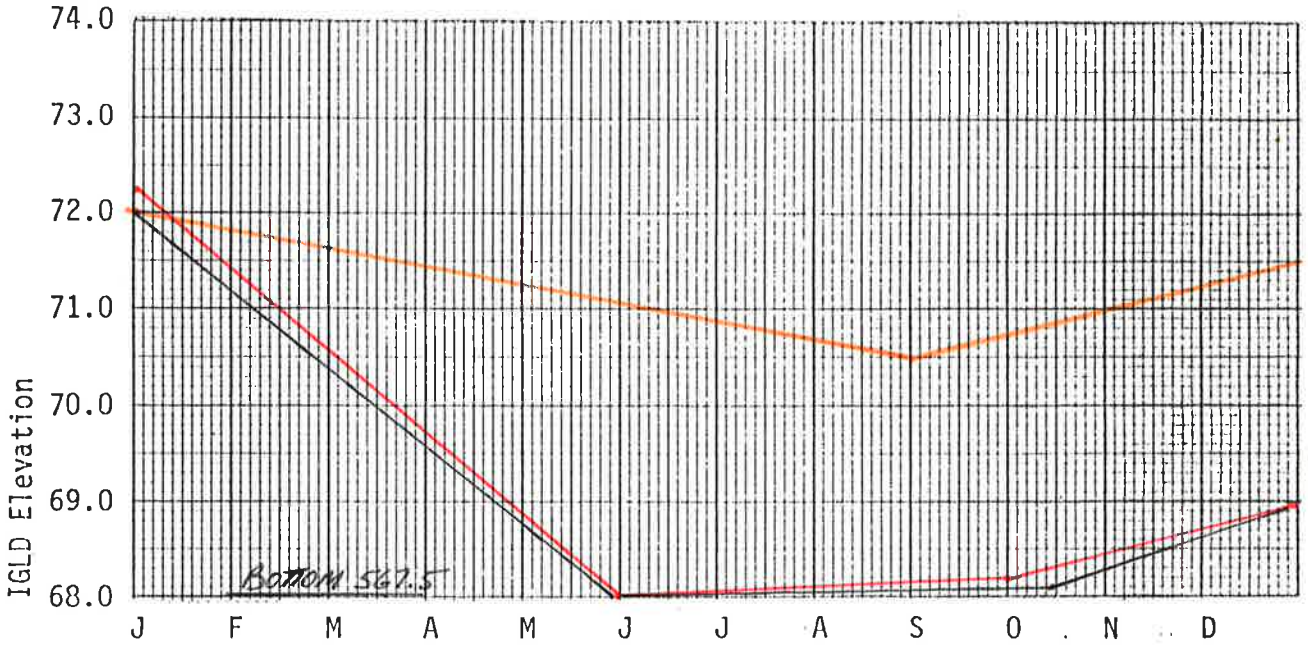
Facilities: The north, east and west dikes are eroded on both sides and need resloping and rip-rap protection. The south dike is in good condition.

Costs: All dikes were mowed twice with no pumping costs incurred.

B.2 Objectives of 1987 Proposed Water Levels

Drawdown for annual production and to re-vegetate. Lowering of water levels probably not possible due to lake levels.

1. Unit Darby Pool 4
2. Acres 170
3. Maximum elevation permissible 573.5
4. Flowline elevation of lowest structure 566.6
5. Elevation of general pool bottom 567.5
6. Water levels: 86 Planned ——, 86 Actual ——, 87 Planned ——



7. Vegetation: Marsh Successional Stage(1-5) 5

Species	%1984	%1985	%1986
Open Water	90	90	90
Water Lilly	2	2	2
Cattail	1	1	1
Cottonwood/Willow	5	5	5
Other	2	2	2

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	5,000	5,000	1,500
Geese	2,000	2,000	500
GBH	500	500	500

9. Map: No map - photo 8/15/87

10. Purple Loosestrife: Several scattered plants and groups were sprayed by airboat.

Darby Pool 4

A.2 Effects of Past Year's Water Levels

Levels: Water levels were well above those planned with runoff from adjacent private lands preventing any drawdown.

Results: All emergents are gone with no submergents present.

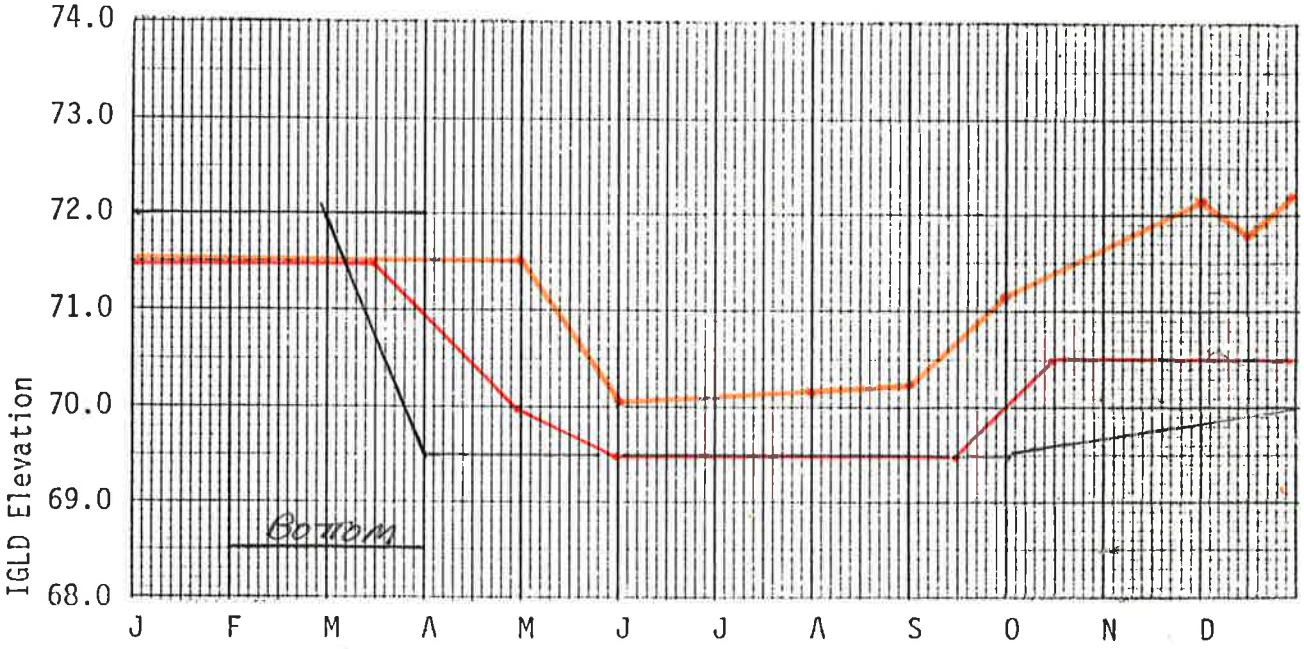
Facilities: The west and south dikes are eroded on both sides and need resloping and rip-rap protection. The north and east dikes are in good condition.

Costs: All dikes mowed twice-no pumping costs incurred.

B.2 Objectives of 1987 Proposed Water Levels

A drawdown for annual production is needed and planned but probably won't happen due to high lake levels.

1. Unit Navarre Pool 1
2. Acres 130
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 569.5
5. Elevation of general pool bottom 568.5
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned——



7. Vegetation: Marsh Successional Stage(1-5) 4

Species	%1984	%1985	%1986
Open Water/Water Lilly	40	40	60
Cattail	30	30	20
Bulrush	10	10	5
Cottonwood/Willow	10	10	10
Other	10	10	5

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	40,000	40,000	50,000*
Geese	20,000	20,000	100,000*
Great Blue Herons	2,000	2,000	10,000*

9. Map: No map - photo 8/15/86

10. Purple Loosestrife: None observed.

*Improved census data available and used. Large numbers of local resident Canada's use the area and most of the geese reported are non-migratory.

Navarre Pool 1

A.2 Effects of Past Year's Water Levels

Levels: Water levels were maintained as planned with slight variations in late summer due to heavy rainfall in August-September. There is considerable variation in botton elevation with summer levels 18" off the general bottom providing a wide range of depths.

Results: Objectives of achieving a 1:1 interspersion of vegetation to open water was achieved where possible. Cattail stands to the east and west of the deep bay were honeycombed with muskrat openings. Submerged aquatics were dense in the bay with little problem noted from shading waterlilly.

Facilities: Only the boundary signs are maintained by the refuge.

Costs: All pumping costs were paid by Toledo Edison.

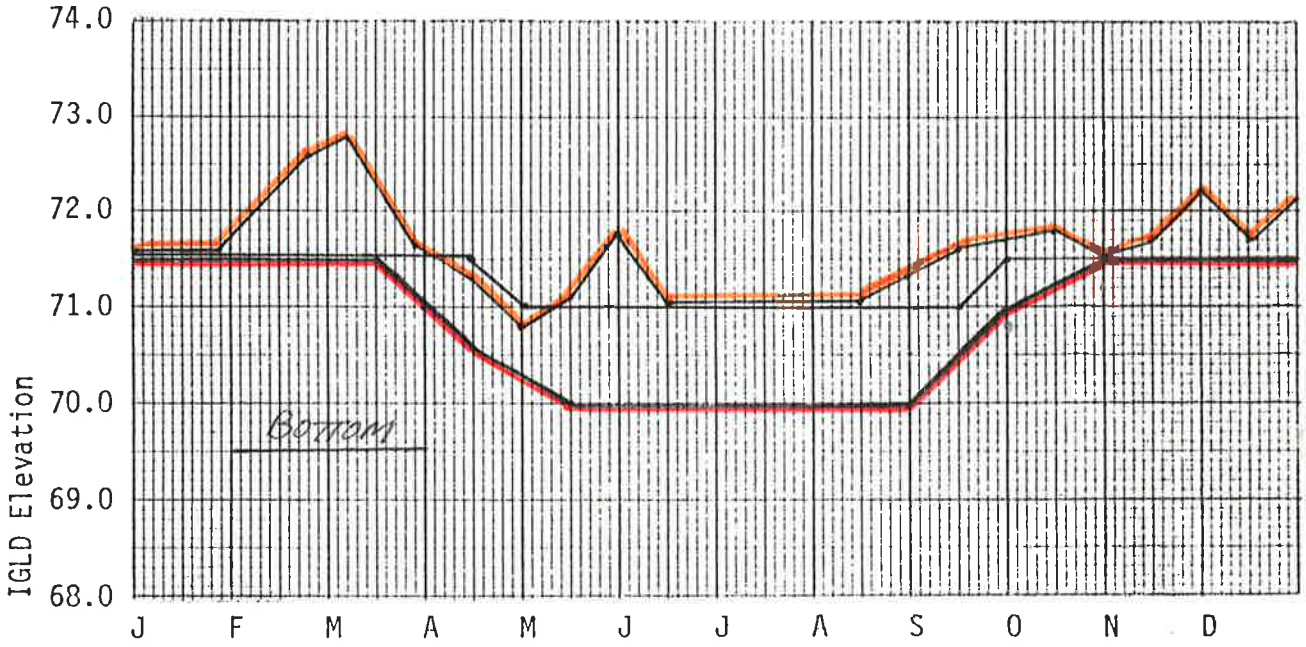
B.2 Objective of 1987 Proposed Water Levels

Drawdown in April to 12" above general pool bottom to continue muskrat opening of dense emergents and for duck brood production. Check closely for purple loosestrife with a complete drawdown planned for 1988. Fill only to 2' above pool bottom in fall to avoid excessive depth for surface feeding waterfowl.

0.04

0.5

1. Unit Navarre Pool 2
2. Acres 340
3. Maximum elevation permissible 573
4. Flowline elevation of lowest structure 569.5
5. Elevation of general pool bottom 569.5
6. Water levels: 86 Planned——, 86 Actual——, 87 Planned——



7. Vegetation: Marsh Successional Stage(1-5) 4

Species	%1984	%1985	%1986
Cattail	45	40	30
Bulrush	15	15	10
Burreed	10	10	5
Waterlilly	15	20	35
Other	15	15	20

8. Wildlife Use:

	Use Days 1984	1985	1986
Ducks	120,000	150,000	140,000*
Geese	60,000	70,000	260,000*
GBH	8,000	10,000	30,000*

9. Map: No map developed - photo 8/15/86

10. Purple Loosestrife: None observed.

*Improved census data available and used. Large numbers of local resident Canada's use the area and most of the geese reported are non-migratory.

Navarre Pool 2

A.2 Effects of Past Year's Water Levels

Levels: Water levels were maintained per the plan with three exceptions noted. In early spring a stuck flapgate permitted levels to exceed the plan by 1.3'. Rainfall in May-June also exceeded the plan for a short time. Personnel changes at Davis-Besse required several reminders to the staff of the importance of closely following the plan. The elevation of general bottom at 569.5 is a average with considerable variation across the pool. At the planned level of 571.5 dense emergents in the east-southeast sections are in only 6" of water. Emergents in other sections are covered by up to 3' of water.

Results: The 86 objective of opening up dense emergents and achieving a 1:1 interspersion of vegetation to open water was achieved as much as possible. In a few areas most cattails were dead, in most sections hundreds of muskrat houses developed and in the higher east-southeast sections few openings developed. Excellent submerged aquatics were present in portions of the deeper central bay. A trapping bid for the unit of $3,400 gives an indication of the number of muskrats present.

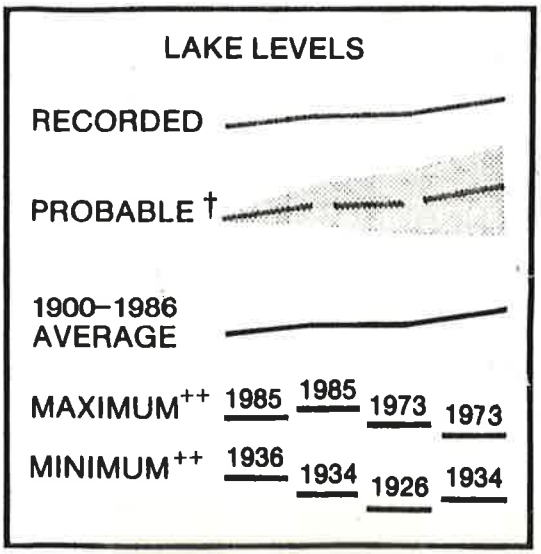
Facilities: Only the boundary signs are maintained by the refuge.

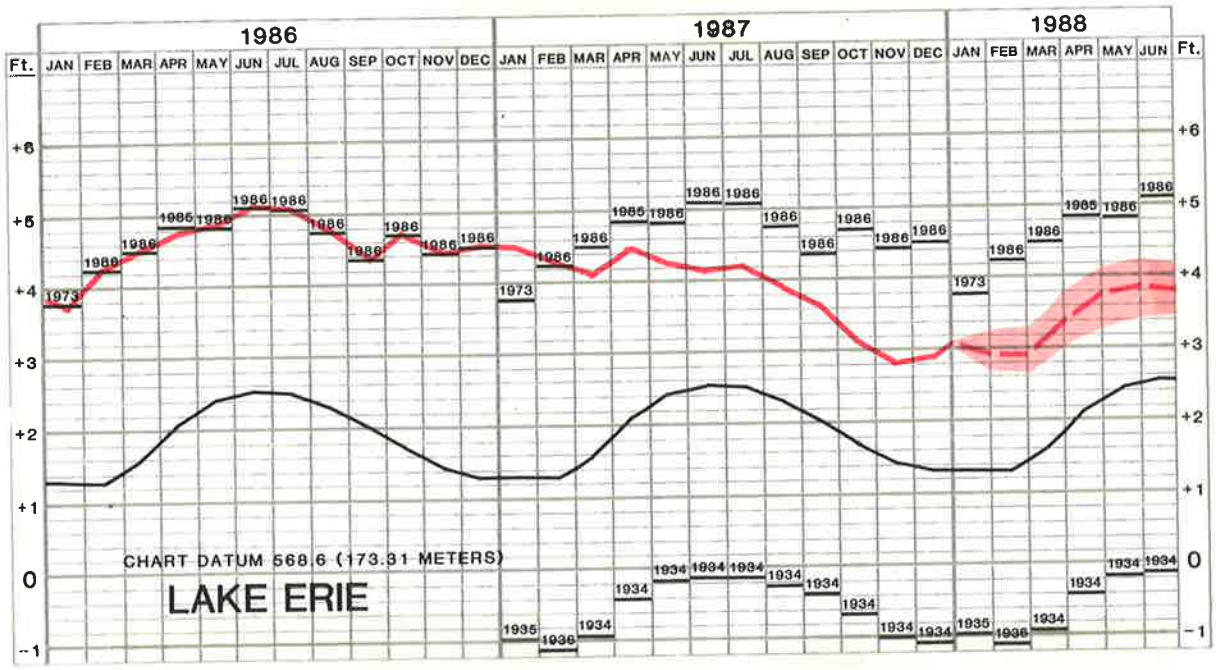
Costs: All pumping costs were covered by Toledo Edison.

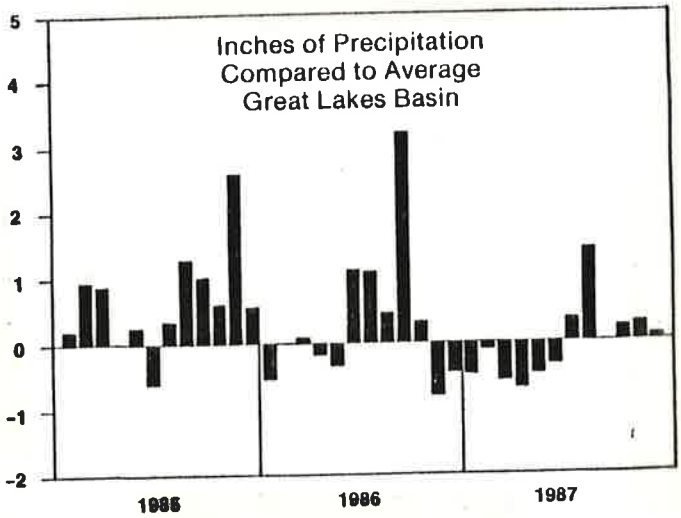
B.2 Objective of 1987 Proposed Water Levels

Drawdown to 6" above general pool bottom for annual plant production and to re-establish emergents. Determine % of exposed bottom and plant response. If plant response is poor lower levels in late June to general bottom. A 6" depth over a portion of the unit would provide more brood habitat than a complete drawdown.

LEGEND







Recorded levels for the previous year and the current year to date and the probable levels for the next six months are shown in red. The shaded red area shows the probable range of levels (one standard deviation of the long-term average predictive error) over the next six months dependent upon weather variations.

These are compared with the 1900-1985 average and extreme levels which are shown in black.